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I. Agriculture

Abstract Nos. 1—10

1. Studies on the root formation in certain cultivated plauts. III. relation between primary root formation and canal development in crown roots of rice plants. Shin-ichiro KAWATA (Proc. Crop Sci. Japan. **24**, 232-236, 1956)

As a result of anatomical studies on the root formation in rice plants, the fact was found that, initiation of primary roots of the crown root occurrs at the opposite side of the place where canals develop simultaneously. Therefore, the more the primary roots appear, the more the canals are seen. The formation of primary roots in the soils of paddy field is generally accelerated when it is in the way of oxidation, and the development of canals, on the contrary, is poorer when the soils are reductive.

2. Studies on the elongation of rice coleoptiles. Tomota SUGAWARA (Proc. Crop Sci. Soc. Japan **24**, 173-175, 1956)

Several experiments were carried out in order to investigate the mechanism of rice coleoptiles in anaerobic conditions. The rice coleoptile elongates more extensively under anaerobic conditions than in aerobic conditions. The elongation of coleoptile cannot be inhibited by 2, 4-dichloroanisole; that is an anti-auxin. Rice coleoptile is a very exceptional tissue, and investigation of its elongation and respiration has led to some unusual results. Its very rapid elongation and respiration cannot be inhibited by cyanide, azide, carbon monoxide, or malonic acid; that is to say, by any of the inhibitors to which cytochrome oxidase and its associated succinic acid dehydrogenase are particularly susceptible. No cytochrome oxidase can be extracted by any of the usual methods, and the other metallic-enzymes, polyphenol and ascorbic acid oxidase, seem to be absent also. Since the activity of homogenates is greatly increased by the addition of riboflavin, and the respiration of the tissue is markedly sluggish toward oxygen, it is probable that the role of the terminal oxidase might be here filled by a non-metallic flavoprotein enzyme.

3. Changes of principal components in the sweet-potato plants in the growing period. Yoshiji TOGARI and Yoshinobu SHIRASAWA (Proc. Crop. Sci. Soc. Japan **24**, 99-102, 1955)

In order to make clear, the basic principles of the high yield of sweet potato, variety Norin No. 10 was planted for this experiment in the year of 1953, in which, the increase or decrease of essential components, in the different organs, during their growing period have also been carefully studied. The results obtained are as follows:

(1) N or K_2O percentage in the leaf-blade reach to the maximum, in the middle of July, and during this period, the formation of tuberous root is also observed with the naked eye.

(2) Immediately after the N amount in the leaf-blade or K_2O amount in the petiole attains the maximum, that is, after Aug. 20, and at that time starch in the tuber increases very rapidly. This period is the leading thickening stage of tuberous root.

(3) The starch percentage in leaf-blade becomes constant after July 11, so that it is presumed that assimilated starch is transfered directly to the tuber without being stored in the aerial part of plant body like other crops.

(4) In order to make survey on the growth of tuberous root, it will be appropriate to investigate the maximum percentage of N and K_2O in leaf-blade, and also maximum amount of N in leaf-blade and K_2O in petiole with reference to various environmental conditions.

(5) Some portions of components in the tuberous root are presumed to be transfered from the aerial parts of plan body after a short stay. Their proportions are as follows:

N	50%	especially from leaf-blade
P_2O_5	20%	〃 〃 〃
K_2O	22%	〃 〃 petiole
Total sugar	10%	mainly from stem
Starch	3%	〃 〃 leaf

4. Studies on the yield analysis of soybean. (I) Changes in principal chemical constituent of the soybean plant in relation to its growth. Yoshiji TOGARI, Yasumasa KATO and Morie EBATA (Proc. Crop Sci. Soc. Japan **24**, 103-107, 1955)

Shirobana-sai No. 1, an early variety of soybean, was grown under usual conditions in order to be examined for total sugars, starch, total nitrogen, phosphorus, potassium and crude ash in each organ. Samples were taken at everytenth day throughout the growing period. The results obtained are as follows.

In stages prior to the flowering, the increase of all the constituents took place very slowly.

During the flowering period, there was a remarkable increase in the accumulation of carbohydrates (sugars and starch) and potassium in the aerial parts of the plant. This was followed by the increase in nitrogen, phosphorus and crude ash, and rapid absorption of the above mentioned constituents took place in the pod-developing stage.

The phosphorus absorption was almost similar to that of nitrogen. The absorption of these elements continued strikingly upto the maturity period in order to fulfil the necessary requirement for the growth of the seeds. In the stems, the leaves and the pods, all the above mentioned constituents attained to their maximum amounts between 10-20 days after the end of the flowering period.

Comparing these results obtained from Shirobana-sai No. 1 with those of the other varieties, no significant results have been obtained in the accumulation of nitrogen and ash. But in regard to phosphorus and potassium, chemical analysis has not been made.

In all the varieties examined the leaves played an important role, with few exceptions, both in accumulation process and also in the translocation of those constituents to the seeds. Therefore, the yeild analyses of these varieties may be possibly accomplished by investigating the amount of principal constituents accumulated in leaves, at the stage accomplished certain days (10-20 days in Shirobanasai No. 1) after the end of flowering, and also by observing the level of accumulation changes which may be effected by environmental conditions.

In this experiment, however, the behaviour of carbohydrates seemed to be one

of the varietal characteristics. Therefore, these differences among the varieties should be considered before the observation is made.

5. Studies on CO_2 exchange in crop plants. III. The effect of light intensity and spacing on the photosynthetic rate of rice-seedlings. Tomoshiro TAKEDA and Hiroshi MARUTA (Proc. Crop Sci. Soc. Japan **24**, 34-40, 1955)

In the previous paper the authors have discussed that the rice plants after transplanting have got different demands for light in order to have their maximum photosynthetic capacity accompanying with their different growing stage, and this differences of demand for light by the plants was due to the differences in conditions of receiving the light, which was greatly influenced by the mutual shading rate of leaves. It is quite clear that the spacing differences of seedlings in the nursery bed is remarkably different from that of the plants after transplanting; therefore, in this paper the authors have tried to clear the relationship between the spacing of seedlings and the demands for light by the seedlings. The effect of light intensity on the photosynthetic rate of seedlings in different spacing, that is thin, intermediate and thick, and also in the different growing stages of the plant, was measured by the apparatus described in the previous paper.

The results obtained were as follows:

(1) At the early stage of growth (4.1 leaf stage) the demands for light by the plants for their maximum photosynthetic rate are comparatively low, and the saturation points lie under 30, 50 and 80 k. Lux respectively.

(2) With the progress of growth, the demands for light of thick seedlings increase remarkably, and at the 5.2 leaf stage, that is, at the middle stage of growth, the saturation point does not exist within the range of below 100 K. Lux; on the other hand, the demands for light by the intermediate and thin spacing seedlings increase gradually, and at the 7.5-7.7 leaf stage, that is, at final stage, the saturation point of the former lies above 100 K. Lux and that of the latter lies below 80 K. Lux.

(3) It has been observed that after 4.1 leaf stage the increasing rate of dry weight of the thick spacing seedlings were less in comparison with that of intermediate and thin spacing seedlings, and after 5.2 leaf stage the increasing rate of dry weight of the intermediate seedlings were less than that of the thin seedlings.

(4) At the final stage, the photosynthetic rate of thick spacing seedlings were less than that of intermediate under the light intensities below 80 K. Lux. This relaion is also shown in the growth curve obtained from the seedlings grown under the unfavourable climatic conditions, and in this case the seedlings were affected by the unfavourable climatic conditions especially at the middle and final stage of their growth, and according to the obtained data, it can be said that the increasing rate of dry weight of thick spacing seedlings were less than that of intermediate seedlings. On the other hand, the data obtained from the seedlings grown under the favourable climatic conditions showed that the increasing rate of dry weight of thick spacing seedlings were equal to that of intermediate seedlings.

In conclusion, it can be said that at the middle stage of growth in the nursery bed, the thick spacing seedlings have got no saturation point under the natural conditions, on the other hand, thin spacing seedlings have got saturation point till the final stage to come. In intermediate spacing seedlings, which is common in nursery bed

in Japan, the saturation point is comparatively low at the early stage, but with the progress of growth it increased gradually, and finally reached to the state of having no saturation point under natural conditions.

6. Studies on CO_2 exchange in crop plants. IV. Roles played by the various parts of the photosynthetic organs of rice plant in producing grains during the ripening period. Tomoshiro TAKEDA and Hiroshi MARUTA (Proc. Crop Sci. Soc. Japan **24**, 181-184, 1956)

Experiments were made on rice plants in order to analyse the roles of the leaves and ears in assimilation and grain production during the ripening period, indirectly by means of artificial defoliation and shading of leaves or ears. Photosynthetic rate and respiration rate of various organs were measured by the apparatus described in the authors' previous paper. The results obtained may be summarized as follows:

(1) Shading of ears and both the shading and defoliation of leaves starting from the heading stage, gave remarkable effects on the grain yields, while the effects were negligible when the treatment was started 20 days after heading, and they were intermediate when it was started 10 days after heading and was continued upto ripening period. From this results, it was elucidated that the translocation of carbohydrates to grains had nearly finished 20 days after heading in rice plant.

(2) About 1/3 of the grain yield quantity seemed to be contributed by translocated assimilates synthesized before heading.

(3) From the results of shading the ear, it was found that the ear itself had acted as an assimilating organ, as shading of it induced a decrease of 8% of grain yields. On the other hand, the apparent photosynthesis of ear, measured by gas analysis, was found very low or sometimes even negative. It might be due to the fact that the amount of respiration in this organ was very large as compared with that of assimilation.

(4) The flag leaf did not seem to be a mere storage organ of assimilates synthesized before heading, but had proved itself to be a photosynthetic organ after heading. On the other hand the 2nd, 3rd and 4th leaves played more important roles as storage organis than as photosynthetic one.

(5) After heading, the photosynthetic activity of the 4th leaf decreased remarkably with the progress of maturation, followed by depression in the activity of the 3rd and then by that of the 2nd leaf. The flag leaf, however, kept its photosynthetic activity till late through the ripening period.

7. Studies on the effect of internal nitrogen concentration of rice plant on the constitutional factor of yield. Atsuhiko KUMURA (Proc. Crop Sci. Soc. Japan **24**, 177-180, 1956)

Effect of internal nitrogen level of rice plant on its constitutional factors of yield, namely the number of stems per plant, number of spikelets per panicle and weight of a grain, was investigated.

Pot cultures of rice plant Norin No. 29 were divided into two groups which received different amounts of nitrogen fertilizer, i.e. heavy (H) and light (L) respectively. At certain stages of their growth they were dressed with various additional amounts of nitrogen. By means of this procedure various grades of N-level in the

plants were maintained, and, under such a condition the magnitudes of the yield constitution factors were examined in relation to the N-levels in the plants.

The results obtained may be described as follows:

(1) Internal level of nitrogen at tillering stage presented distinct effects on tillering, correlation coefficient between the number of tillers per plant and N% of the leaf blade (this was employed as a indicator of nitrogen level in plant) being high, (H:$r=+0.969$ and L:$r=+0.968$).

(2) High correlation coefficients were obtained between the average nitrogen concentration during 7 to 28 days before heading and the number of spikelets per panicle of main stem, (H:$r=+0.961$ and L:$r=+0.979$). Regression equation was $y=39.3X+7.1$ for H and $y=36.0X+17$ for L, where y: number of spikelets per panicle of main stem, x: mean of N% of leaf blade during 7 to 28 days before heading. It can be understood from the above mentioned data, that the yield may be lowered strongly by deficiency of nitrogen in that particular period.

(3) Extreme deficiency of nitrogen at the ripening period caused reduction of weight of a grain. The weight of a grain may be increased with the increase of nitrogen concentration in this low N% zone. But above certain critical concentration no such effect can be expected. It was observed that when nitrogen existed in excess, reduction in weight of a grain might take place.

8. **Studies on the characters of seeds and their aftereffects on the following generation of rice plants cultivated at different localities.** Takane MATSUO, Yuzo FUTSUHARA and Ken-ichi OSONE (Japan Journ. Breed. 5, 15-24, 1956)

It is a very important problem for the seed production to clarify the effects of environmental factors on the characters of rice seeds, physiologically and genetically, during the growing and fruiting periods. For the clarification of this problem, we cultivated 3 varieties of same origin at different localities for 3 years and compared them for the characters of their seeds and tested their after effects in regarding to their growth and yields in the following generation in every year.

The results may be summarized as follows:

(1) It has been confirmed that the characters of rice seeds cultivated at different localities and their seedling growth in the following generation were remarkably different.

(2) In general, the large seeds were produced in intermountainous regions and in level lands under favorable environmental conditions and their plant growth in the following generation was remarkable.

(3) The above mentioned differences faded away in their later stages of growth, but it has been found that in the degraded soil areas and the highlands of cool climate, these after effects remained through out the whole life of plants growth.

(4) The accumulative effects has not been recognized upon the characters of seeds and their after effects in the following generation. In same localities, larger seeds were better in their growth in the following generation. Therefore, seed selection by salted water seems to be effective practically in crop culture.

(5) It seems that these effects upon the basic characters of rice seeds cultivated at different localities consist not only in the morphological characteristics (i.e. weight of 1000 grains), but also in their inner effects such as the activity of enzymes.

9. Studies on cucumber mosaic virus. II. The isolation of the virus from various plants showing mosaic in the vicinity of Tokyo, Japan. Yasuo KOMURO and Hidefumi ASUYAMA (Ann. Phytopath. Soc. Japan **20** [2-3], 77-82, 1955)

(1) In a survey for the cucumber mosaic virus, 573 collections of mosaic plants have been made from 1949 to 1955 in the vicinity of Tokyo, from 150 species of plants belonging to 47 families, and inoculated on the differential hosts. Of these collections, 202 samples (35%) from 68 species of plants (45%) in 32 families yielded the cucumber mosaic virus.

(2) Among the hosts previously reported as naturally infected, 37 species were confirmed, in which, cucumber, muskmelon, tobacco, *Primula sinensis*, *P. obconica*, celery, pansy, *Silene armeria*, *Stellaria media*, *Amaranthus blitum*, beet, spinach, *Commelina communis*, and corn are worthy to mention, as they are grown relatively common in Japan, and mosaic of them yielded the virus in higher percentage than 50. The cucumber mosaic virus was isolated hardly or not at all, from the following species: chrysanthemum, *Campanula grandiflora*, dahlia, marigold, red pepper, *Physalis Alkekengi*, bean, pea, *Iris germanica*, narcissus, hyacinth, tulip, calla, and lilies.

(3) Thirty-three species and varieties of plants, previously unreported as hosts in nature, were found infected in the field. These were *Chrysanthemum carinatum*, *Trichosanthes cucumeroides*, *Cucumis melo* var. *Makuwa*, *Luffa cylindrica*, *Myosotis scorpiodes*, *Cynoglossum amabile*, *Asclepias curassavia*, *Vinca rosea*, *Primula malacoides*, *P. veris*, *Cryptotaenia canadensis*, *Godetia amoena*, *Impatiens Balsamina*, alsike clover, radish, *Brassica rapa* var. *Komatsuna*, *B. napus*, *B. cernua*, *B. pekinensis*, cabbage, *Dianthus chinensis*, *D. superbus*, *Lychnis coronaria*, *Gypsophyla elegans*, *Cerastium vulgatum*, *Portulaca oleraceae*, *Gomphrena globosa*, *Amaranthus tricolor*, buck-wheat, *Zingiber Myoga*, *Tradescantia reflexa*, *Pollia japonica*, and *Colocasia antiquorum*. Among them, *Chrysanthemum carinatum*, *Cucumis melo* var. *Makuwa*, sponge gourd, *Cryptotaenia*, radish, buck-wheat, and *Colocasia* are grown rather common in the gardens, and have been found infected frequently by the cucumber mosaic virus.

(4) Occurrence of mosaic plants of *Commelina communis*, *Stellaria media*, *Trichosanthes cucumeroides*, *Cerastium vulgatum* and *Zingiber Myoga* by cucumber mosaic virus are sufficiently common to be regarded as a part of source of infection.

10. Studies on the motley dwarf disease of carrot caused by an insect-transmitted virus. Yasuo KOMURO and Isao YAMASHITA (Ann. Phytopath. Soc. Japan **20** [4], 155-160, 1956)

A new disease of carrot showing a stunted, unthrifty appearance suggestive of mineral deficiency has been noted in Kanto District since 1951. Foliage symptoms consisted of irregular chlorotic mottle, yellow veinclearing, and distortion or reduction in size of leaflets. Sometimes growth stunting and rosette were severe. No necrosis was observed on leaflets, stems and roots.

The disease was proved to be caused by a virus, which is transmitted by the aphid, *Brachycolus heraclei*, a common infestant on carrot in Japan, but not by *Myzus persicae*. Negative results were obtained by mechanical inoculation with carborundum or pin-puncture method, and there was no evidence of transmission through carrot seed.

The vector acquired the virus after an infection feeding period of 1 to 24 hours and virulieferous aphids could transmit with an inoculation feeding for 24 hours. The virus was of a persistent type and viruliferous vector remained infective for a

period of up to fifteen days in a series of transfer experiments. There appeared to be evidence of the presence of a latent period in its vector.

Carrot was the only known natural host of the virus. Celery was experimentally infected, but *Cryptotaenia canadensis* and parsely were not infected.

From the symptoms, the mode of transmission, restricted host range, long persistence in its vector etc., the virus in consideration may be closely related with the carrot motly dwarf virus described by STUBBS (1948) in Austlaria.

With cucumber mosaic virus from petunia, mechanical inoculation to carrot failed to produce infection.

II. Agricultural Chemistry

Abstract Nos. 11—53

11. The nitrogen distribution of soil organic matter and its relation to the type of humus. Kenzô KÔBÔ, Ryô TATSUKAWA and Yutaka ÔBA (Trans. 6th. Internat. Cong. Soil Sci. 1956)

The relation between the nature of humus and nitrogen distribution was investigated, making use of several volcanic ash soils and paddy field soils. The results obtained are summarized as follows:

(1) The humification degree of the organic matter is generally higher in volcanic ash soils than in paddy soils. The inverse relation can be seen in the percentage of acid-soluble-N in total nitrogen of soils.

(2) In the case of volcanic ash soils, the older deposit contains organic matter of higher humification degree, and gives lower percentage of soluble-N after acid hydrolysis. As to the sample from the asme area, it is indicated that, well-drainage and cultivation promote humification respectively.

(3) The amount of NaF-fraction and its humification degree are affected by the amount of exchangeable calcium.

(4) Organic matter of soil residue after acid hydrolysis is almost completely removed by cold NaOH treatment, and its fraction shows exceedingly high RF value and PQ value and contains less nitrogen than NaOH-fraction, but the order of humification degree noticed in NaOH-fractions still remains in this HCl-NaOH-fractions.

12. Physico-chemical studies on the formation of humic acids. Part 5. Absorption spectra of humic acids. Kyôichi KUMADA (Journ. Sci. Soil and Manure, Japan **26,** 97, 1955)

The author studied the absorption spectra of natural and artificial humic acid solutions. The results are summarized as follows:

1. The intensity of light absorption of humic acid dissolved in dilute alkaline solution decreased gradually with the lapse of time at all wavelengths, especially remarkable at longer wave-lengths. But in ultra violet region, the absorption intensity

tended to increase again after about 50 days. In the case of soil humic acids, the decrease of light absorption was greater with the lowering of humification. Artificial humic acids were very unstable compared with natural soil humic acids. 2. The absorption curves of the soil humic acids hardly changed their shapes after the acids were reprecipitated 5 to 7 times, but the curves of artificial humic acids showed an inclination of getting steep shape after the reprecipitation. This inclination was probably due to the partial decomposition or denaturation of the acids. 3. No absorption bands were found in the absorption spectra of humic acids in the visible region except in those from podsol and diluvial soils. The humic acids from these soils showed absorption bands clearly at about 620 mμ and somewhat indistinctly at about 570 and 470 mμ. 4. Absorption curves of humic acids were very similar in their shapes at the wavelengths from 200 to 2,000 mμ having a lowest part at about 1,100 mμ, and turning upward from this wavelength.

Part 6. Elementary composition of humic acids. K. KUMADA (Journ. Sci. Soil and Manure, Japan **26**, 179, 1955)

Elementary analyses of various soil humic acids were conducted. Humic acids were extracted by hot dilute alkali from soils and peats which were either pretreated by 5% hydrochloric acid or not (of these humic acids the one which was extracted after acid pretreatment was provisionally designated as SrL humic acids and the others, not pretreated, as L humic acids). Humic acids extracted after Simon's method were also used (these humic acids were designated as Si humic acids).

Elementary composition of humic acids was different with the sources and changed according to the extraction practices. In general, carbon and nitrogen contents of Si humic acids were considerably lower than those of L and SrL humi cacids. SrL humic acids showed higher carbon and nitrogen contents than those of L humic acids. It was found that elementary composition of L or SrL humic acids varied regularly with their degree of humification.

It may be reasonable to suppose that the forming process of humic acid consists of two stages; during the first stage, acculation of nitrogen in the nitrogen-free basic materials (which might be lignin) takes place, accompanied with the decrease of its carbon and increase of its nitrogen contents. During the second stage, humic acid thus formed are transformed to the deeply colored substances, losing its nitrogen and methoxyl group.

Part 7. Comparison of humic acids obtained by different methos of extracion. K. Kumada (Journ. Sci. Soil and Manure, Japan **26**, 231, 1955)

SrL humic acids, humic acids obtained by treating L or Si humic acids with 5% HCl at 70°C and the acids treated by 0.5% NaOH at 100°C for 30 minutes were compared with each other to study their absorption spectra and elementary composition.

Above mentioned acid or alkali treatment seemed to cause no fundamental change in the nature of the humic acids, although there occured a slight decrease of light absorbability of these humic acids. The intensity of light absorption of humic acids was more or less greater than that of the original humic acids, their carbon contents becoming higher and their nitrogen contents lower. These changes took place remark-

ably on the humic acids of low humification degree. It may be presumed that humic acid extracted from soil, no matter what extraction method may be applied, contains not only humified organic matter, in its true sense, i.e. organic matter which shows characteristic absoption spectrum, but also non-humic, that is, fresh or somewhat decomposed and transformed organic matter. The more the method of extraction, pretreatment of the samples and its after-treatment are drastic, or the more the humification is promoted, the more the non-humic matter contained in the humic acid may be decreased.

Part 8. Changes of several properties with the progress of humification. K. KUMADA (Journ. Sci. Soil and Manure, Japan **26**, 287, 1955)

The base exchange capacity, the content of hydrolyzable nitrogen and the amount of permanganate consumption, by humic acids were determined and compared with each other in relation to their degree of humification. The results were summarized as follows:

1. The base exchange capacity of soil humic acids were 300 to 850 m.e. per 100 of water- and ash free substance, and increasing with the advance of the humification degree. 2. The consumption of N/10 permanganate solution per 1 mg. of soil humic acid in acid condition after Simon's method was about 1.5 cc, but somewhat higher in the case of humic acids, which had extremely high or low degree of humification. The consumption of permanganate solution by soil humic acid in alkaline condition was smaller than that in acid condition, and decreased with the progress of humification. 3. The ratio of the amount of hydrolyzable nitrogen to the amount of total nitrogen in humic acid seemed to decrease during the humification process. 4. The base exchange capacity of humic acid prepared from hydroquinone was very high (about 900 m.e.), and that of the one from glucose was low (about 300 m.e.). The exchange capacity of the artificial humic acid containing nitrogen was very small compared with that of the nitrogen-free one. 5. Stability against oxidizing reagent of artificial humic acid was smaller than that of soil humic acid.

According to the experimental results, it may be reasonable to suppose that, with the progress of humification, the base exchange capacity and the stability of humic acid to oxidative action increase, and the nitrogen contained in it becomes fixed more and more concretely. There may exist some essential differences between the structure of soil humic acid and that of artificial humic acid.

13. Dynamic studies on nutrients uptake by crop plants. Part 9. The uptake of K, P_2O_5 and NH_4 by barley seedlings as influenced by 2, 4-Dinitrophenol. Shingo MITSUI and Kikuo KUMAZAWA (Journ. Sci. Soil and Manure, Japan **26**, 241, 1955)

The uptake of NH_4-N, P_2O_5 and K_2O by barley seedlings as influenced by 10^{-4} Mol DNP and 10^{-2} Mol NaN_3 was studied.

It was evident that 10^{-4} Mol. DNP increased the oxygen uptake by barley roots as contrasted to the remarkable depression through NaN_3. Moreover, this effect normally continued during the expected period for measurement and treatment. In either case P_2O_5 excreted out, whereas K_2O was excreted out only by NaN_3, though its uptake ceased by DNP. The uptake of NH_4-N was appreciably depressed by NaN_3 but slightly by DNP.

The result was discussed on the basis of the characteristic different behaviors of the pertinent inhibitors. Assuming that P_2O_5 accumulation is primarily and directly linked with the formation of energy rich phosphate through oxidative phosphorylation, there is no wonder that DNP and NaN_3 should decidedly and equally inhibit P_2O_5 uptake. The excretion of phosphate may be due to the superior counter reaction of organic phosphate towards inorganic phosphate.

K_2O uptake most probably proceeds through the combination of K with certain acceptor at the expense of energy derived from energy rich phosphate bonding such as ATP. NaN_3 inhibits not only this process but also most likely the formation of this acceptor, whereas DNP seems to be almost indifferent to the latter substantial process, resulting in a different inhibition between the two inhibitors.

The first step of NH_4-N uptake is believed to be the combination of $NH^+{}_4$ with certain Keto-acid, and the next step the formation of amide as a result of condensation of the formed amino acid with $NH^+{}_4$. Only the latter process requires energy from the energy rich phosphate bonding such as ATP. Therefore, NaN_3 most probably inhibits both processes and DNP the latter only, resulting in a different inhibition. Moreover, the slight inhibition in general of NH_4-N as compared with P_2O_5 would be attributed to the slower counter reaction in the uptake of N as compared with P.

Part 10. Contact solutional uptake of fused magnesium pnosphate (P^{32}) by acidoidal plant root and unsaturated soil colloid. Shingo MITSUI, Masao NAKAGAWA, Akira BABA, Kiyoshi TENSHÔ and Kikuo KUMAZAWA. (Journ. Sci. Soil and Manure, Japan **26**, 497, 1956)

In a series of the study on the nutrients uptake by crop plants, a dynamic Plant root-Fertilizer particle-Soil colloid relationship was observed in the uptake of phosphoric acid from the fused magnesium phosphate, a kind of hardly water soluble phosphatic fertilizer.

Fused magnesium phosphate and superphosphate of lime labelled with P^{32} corresponding to 30 mg water soluble or 2% citric soluble P_2O_5 per beaker, were mixed with 170 g of quartz sand and with 0, 0.04, 0.2, 1.0, 5.0, 25.0 g of acid soil (Mikatagahara mineral acid soil, the hydrolytic acidity Y_1 of which was 22.5) respectively.

In the third series, labelled superphosphate was added with 71.3 mg precipitated $CaCO_3$, equivalent to the alkalinity of the fused magnesium phosphate.

In each beaker, seeds of wheat, pop-corn, small bean and soybean were sown and seedlings were grown for 17 days under the condition of artificially controlled light and temperature. The tops were cut off close at the ground, ashed and the intensity of P^{32} radiation was measured by G-M-counter.

The outstanding difference between the two phosphates was, that by the hardly water soluble fused magnesium phosphate, the P^{32} absorbed by crop plants remarkably increased as the amount of acid soil increased up to a point where sudden decline set in, while by the water soluble superphosphate, only gradual decrease in P^{32} absorption occurred with increasing amount of added soil as expected. This latter trend could slightly be modified by the addition of calcium carbonate, but was unsimilar to the fused magnesium phosphate, where the maximum peak of uptaken phosphoric acid was extraordinary high.

The phenomena above mentioned were explained on the basis of a hypothetical consideration of the dynamic relationships among Plant root-Fertilizer particle-Soil

colloid. A contact solutional uptake of phosphoric acid, *i.e.* a cationic contact exchange followed by solution and uptake of phosphoric acid by crop plants was proposed schematically.

This hypothesis was supported by several model experiments in the laboratory.

Part 11. Studies on the base exchange capacity of plant roots. Shingo MITSUI, Tetsuya OKAMOTO and Kikuo KUMAZAWA (Journ. Sci. Soil and Manure, Japan **27**, 30, 1956)

In connection with Part 10 of this series of study, the base exchange capacities and the ultimate pH of various plant roots were measured. The methods employed by MATTSON or DRAKE were more or less modified, on the procedures of electrodialysis and titration. The fresh root samples were directly electrodialysed until the electric current lowered approximately to 0.01–0.02 Amp. To put the results on a comparable basis, approximately five minutes was necessary for the neutralization to pH 7. After filtration within about 30 seconds using a glass filter, 100 cc of the filtrate was added with excess acid, boiled five minutes to drive off carbon dioxide and finally titrated back with alkali, utilizing methyl-red as indicator. The base exchange capacities and ultimate hydrogen ion concentrations thus obtained coincided fairly well. The figures were highly significant on 1% level between legumes and cereals in agreement with the results obtained by MATTSON or DRAKE.

Part 12. Effect of the Degree of Base Saturation and Phosphate Fixation on the Contact Solutional Uptake of Phospheric Acid (P^{32}) by Crop Plants Associated by a Pot Experiment to Prove the Hypothesis. Shingo MITSUI, Kiyoshi TENSHÔ and Kiyoshi KURIHARA (Journ. Sci. Soil and Manure, Japan **27**, 59, 1956)

Wheat seedlings were grown by the technique similar to Neubauer but under artificially controlled light and temperature. To each beaker was added a quantity of labelled fused magnesium phosphate, quartz sand and increasing quantities of natural soil differing in the exchange of acidity and phosphate fixation. Similar experiments were conducted with artificial base unsaturated soils, the bases being washed out with 0.1 N HCl.

It can be concluded that the amount of hydrogen ion of soil colloids, which can enter into exchange reaction in KCl solution is of primary importance, contributing positively to the "Contact solutional uptake" of phosphoric acid from fused magnesium phosphate, a kind of water hardly soluble but 2% ciric acid soluble phosphatic fertilizer, and that of second in importance, as negative factor is the power of phosphate fixation of the pertinent soils. This mechanism was also proved to hold good over the whole growth period of millet in a pot experiment.

The results might well suggest a new method of dressing for such kinds of phosphatic fertilizer, if the soil is acid, to mix preliminarily the fertilizer with some does of soil, as contrasted to the normal recommendation for superphosphate not to mix it with soil.

14. Investigations on the radioactive contamination of crop plants as a result of H-Bomb detonation. Part 1. Radioactive contamination of crop plants and soils. Shingo MITSUI, Sueo ASÔ, Kiyoshi TENSHÔ, Kikuo KUMAZAWA and Kenzô MIYAWAKI. (Soil and Plant Food, **1**, 15, 1955)

Since the discovery of radioactive rain-out covering Japan in March-May 1954,

due to the H-Bomb detonation at Bikini atoll, the authors started assaying the possible radioactive contamination of crop plants grown at Tokyo districts.

Seventy four samples of leaves and other parts of various plants, including cereals, vegetables, fruits and tree leaves, were collected from the premises of the University and the suburbs of Tokyo. First, general radiactivity were surveyed for on these samples.

Strong radioactivity was detected on such rough surfaced plant parts as welsh onion flower, radish leaves, barley or wheat ear and Japan cypress leaves. On the other hand, lower leaves of large trees, and grasses in the shade of trees showed only weak radioactivity.

Next, the effect of water washing for the removal of the radioactivity was examined. The results obtained were that the decontamination by repeated washing with tap water was occasionally very imperfect, indicating the possible intake of the fission products through roots and leaves.

To eliminate the natural radioactivity (K^{40}), the next assaying method was used; Plant materials were carefully washed, oven dried, then 5-10 g of each material were ignited at 400-500°C in a muffle. The ashes were extracted with HCl to eliminate the natural radioactivity of K^{40} by precipitating with NH_4OH and $(NH_4)_2CO_3$. One of the most important feature was that radioactivity was detected on the tops, but not practically in the roots.

Then, radioactive contamination of soils were also detected. Generally, soils which have a soft structure and good drainage as cultivated soils were weak in radioactivity, and those which have a hard structure and bad drainage, relatively strong.

Meanwhile, on May 21, the fall-out, which was taken from one square meter on the glass roof of the greenhouse of the University, amounted to approximately 1 g. and showed 2098 counts/min. About one third of this radioactivity was still detected on August 8, indicating that there remained certain long half life elements.

Part 2. Root and foliage uptake of "Bikini Ash". Shingo MITSUI, Sueo ASÔ, Kiyoshi TENSHÔ and Kikuo KUMAZAWA. (Soil and Plant Food **1**, 17, 1955)

The radioactive ash for experimental use, referred to as "Bikini ash", was prepared by igniting the heavily contaminated substances on board No. 5 Fukuryu Maru.

1. The "Bikini ash" was extracted with water, 2% citric acid and conc. HCl respectively. The three extracted products were neutralized to pH 5.0–5.5 and were respectively painted on the second leaves of squash plants. After six days the plants were harvested, cut into several parts, ashed and assayed for radioactivity. The sample plants treated with 2% citric acid were subjected to the radiochemical group analysis with the use of ion exchange resin.

The uptake and translocation of the radioactive fission products through leaves was undoubtedly established in any extract of "Bikini ash". Moreover, it was observed that more than half of the radioactivity of "Bikini ash" was in the rare earth group. The percent absorbed, however, was lowest in the same group.

2. To know the effect of various kinds of salt, including nutrient elements, and also of the presence of surface active colloid such as soil in the root medium upon the uptake of "Bikini ash" by plant roots, an experiment was conducted with wheat

seedlings employing the technique similar to Neubauer.

The presence of surface active colloid such as soil in the root medium remarkably depressed the uptake of fission materials. Moreover, massive accumulation of radioactivity occurred in the roots, and only about 10% of the accumulation was translocated on the tops. Further, it appeared that the uptake was slightly increased by adding amonium salts such as $(NH_4)_2SO_4$ or NH_4Cl, and considerably decreased by adding phosphate as monocalcium phosphate.

15. Effect of fused magnesium phosphate on paddy grown in "akiochi" soil with particular reference to phosphorus and silicon. Masao NAKAGAWA, Akira KITAMOTO and Isao TANGE (Soil and Plant Food, **1**, 27-28, 1955)

The authors conducted a series of pot experiments to compare the effect of fused magnesium phosphate with that of superphosphate on paddies grown successively in an "akiochi" soil. Results indicated that the soil was deficient not only in phosphorus, but also in silicon available to the plant. The superphosphate treatment caused "akiochi", a kind of crop failure, whilst the fused phosphate treatment increased the crop yield as well as the silicon uptake, indicating that this fertilizer was an excellent source of both plant nutrients, phosphorus and silicon.

The poor silicon uptake of the paddy was probably not the effect of the poor crop, but its cause. Silicon deficient soils which need silicious fertilizers may be commonly found in low productive paddy fields.

16. Effect of soil conditioners on increase of phosphate availability, similar to humic acid. Part 1. Krilium treatment in relation to fixation by soil. Shingo MITSUI, Kiyoshi TENSHÔ, Kiyoshi KURIHARA (Journ. Sci. Soil and Manure, Japan **26**, 359, 1955)

Soil conditioners have widely been studied in connection with their effect on the physical properties of soil. The poly-organic acid properties of these materials, however, might as well affect the chemical properties of soil, such as phosphoric acid fixation, ion exchange capacity etc. similar to humic acid.

Five g. of Tanashi volcanic ash soil preliminarily added with various amounts of Krilium 6 or 9 were shaken with 50 cc phosphate solution containing 25 mg. P_2O_5 as K_2HPO_4 at various regulated pH. The fixation of phosphoric acid was determined by measuring the residual P_2O_5 in the solution.

The application of Krilium 9 at comparatively low concentrations of 0.05–0.2% was almost indifferent to or slightly promoted phosphate fixation possibly due to a slight lowering of pH. Comparatively higher concentrations of 0.3–2.0% Krilium 6 and 9 evidently depressed the phosphate fixation compared at the same pH level. The addition of $CaCO_3$ prior to the application of Krilium almost did not alter the general trend. Sodium humate, which was prepared from the pertinent soil, similarly and equally affected the phosphate fixation as Krilium.

The mechanism was discussed on the basis of the acidoidal and complex forming properties of these materials.

Further, it was suggested that the simultaneous band application of Krilium with fertilizers containing phosphate would be beneficial in promoting the phosphate availability.

Part 2. Effect of soil conditioner treatment on growth, yield and composition of wheat in greenhouse experiments. Shingo MITSUI, Kiyoshi TENSHÔ, Kiyoshi KURIHARA (Journ. Sci. Soil and Manure, Japan **26**, 435, 1955)

A series of pot experiments with wheat were conducted to elucidate the possilbe promotion of phosphate availability by soil conditioners.

Krilium 6, 9, Aerotil and Na-humate were applied in three different placements. In block placements similar to band placement in practical fields, the concentration of soil conditioners will undoubtedly be high around fertilizers as compared with the apparent percentages.

In general, the growth and yield of wheat were evidently improved when the concentrations of soil conditioners were expected to be high enough to actually prevent phosphate fixation, as reported in the previous paper (Part 1). The ultimate reason was attributed to the surprisingly increased uptake of phosphoric acid by wheat plant, although the uptake of N and K more or less increased.

The result may suggest a new promising application of soil conditioners, aiming directly at the improvement of chemical properties of soil i.e., prevention of phosphate fixation, rather than the improvement of soil structure.

17. Studies on translocation of nutrients in crop plants. Part 1. Sueo ASÔ and Mitsunori KINOSHITA (Journ. Sci. Soil and Manure **26**, 387, 1956)

(1) To separate P^{32} from Ca^{45} the authors devised a method, making use of their difference in β-ray energy. The maximum energy of β-ray is 1.72 Mev. from P^{32}, and 0.26 Mev. from Ca^{45}. According to this method, P^{32} and Ca^{45} could be traced independently at the same time in one plant, individual difference of plants being eliminated.

(2) By this separation method, translocation and distribution of P^{32} and Ca^{45} in soybean plant was examined, and the authors found that the translocation rate of "Ca" was slower than that of "P". The amount of "Ca" in the root decreased as it translocated to the top, but the amount of "P" in the root progressively increased.

(3) It was concluded, therefore, that distribution and translocation of "P" would be dependent on the metabolic factors, i.e. respiration and photosynthesis. On the other hand, those of "Ca" would be dependent rather on non-metabolic factors such as exchange and diffusion. Further, it can be said that "P" is mobile, for it is great in the turn over rate and forms easily mobile compounds, i.e. inorganic phosphates and sugar phosphate ester, whereas "Ca" is inmobile, for it forms hardly mobile compounds, i.e. Ca oxalate and insoluble Ca pectinate.

(4) In the field, the first hunger signs of "N", "P", "K" etc. usually appear in the upper leaves, while those of "Ca", "Fe", "B" etc., in the lower leaves. These phenomena will possibly be explained from the difference between each nutrient in the mode of translocation and distribution in the plant.

Part 2. Sueo ASÔ (Journ. Sci. Soil and Manure **26**, 450, 1956)

(1) Using wheat and tomato, the translocation and distribution of P^{32} and Ca^{45} were examined by radioautograph technic. According to these results, the former element was accumulated intensively in such plant parts, where metabolic activity was vigorous, but the latter was distributed uniformly throughout the whole plant

parts.

(2) The difference between translocation of P^{32} and Ca^{45} ascertained by radio-autograph accorded with the result obtained in the previous report (Part 1).

18. Studies on Isoamlase. Part 8. On the determination of isoamylase activity. Tsuneo KOBAYASHI (Bull. Agr. Chem. Soc. Japan **19**, 163, 1955)

A method for determining the isoamylase activity was devised. A procedure properly diluted enzyme solution is allowed to act at 20°C on a 1% solution of glutinous-rice starch buffered to pH 6.2. After 24 hours, 0.2 cc of the reaction mixture is mixed with 2 cc of 0.01 N iodine solution, and diluted to 25 cc. Optical density (E) of the solution at 620 mμ is read in a Pulfrich photometer, using a 1-cm cell. The increment of E at 620 mμ is proportional to enzyme activity within certain ranges. The amount of enzyme is expressed in the "isoamylase unit", i.e., an increase of E 0.200 being taken as 10 units.

A pH-activity curve is given for yeast isoamylase, which shows a sharp maximum at pH 6.2.

19. Microchemical determination of vitamin A. Part 2. Estimation of vitamin A and β-carotene in blood. Yoshikazu SAHASHI, Akihiko NAKAYAMA and Keiji HARASHIMA (Journ. Agr. Chem. Soc. Japan **29**, 105, 1955)

Validity of Bessey's method for determining vitamin A and carotene contents in blood serum was tested. The extinction curves of β-carotene and lycopene obtained in the kerosene-xylene mixture are illustrated. The extinction coefficient of β-carotene was estimated to be 2420 at 460 mμ, so the value of the conversion factor for calculating carotene content, originally determined by Bessey to be 480, should be revised to 413.

β-Carotene and lycopene had no effect upon the estimated values of vitamin A content in blood serum obtained bythis procedure.

20. An electronically controlled apparatus for the determination of sulfur and halogens. Tetsuro KÔNO, Keiko SATÔ, Mizue SUZUKI aud Ikuko ISOBE (Journ. Agr. Chem. Soc. Japan **29**, 560-5, 1955)

The mechanism of the automatic control of combustion (c.f. KONO et al: Japan Analyst. **3**, 224 (1954), Journ. Agr. Chem. Soc. Japan **28**, 804 (1954)) was applied for the determination of sulfur and halogens. The principle for the determination was based upon the publication by Stragand and Safford (Anal. Chem. **21**, 625 (1949) and **23**, 520 (1951)); i.e. the sample was burnt in a stream of oxygen, and the amount of sulfur and halogens were determined gravimetrically after they were caught on silver-net-rolls as Ag_2SO_4 and AgX, respectively. But in this apparatus, the procession of the movable furnace was stopped automatically when the pressure in the combustion tube was increased, and moreover, the analytical procedures were improved as follows. The silver-net-rolls were simply and satisfactorily reduced electrolytically after each course of an analysis. Either sulfur or halogens could be caught quantitatively with the silver-net-rolls heated at 400–450°, provided that the length of a silver-net-roll was 10 cm, or two 5 cm long rolls were used. More than 150 ml of oxygen was necessary for the complete sweeping of the combustion-products. Platinum contacts and silver-net-rolls were clensed occasionally, lest lower results were obtained.

In general, determination of halogens were more difficult than that of sulfur, because halogens were weighed as halogens themselves while sulfur was weighed as SO_4.

21. On the seasonal variation of the results in the micro determination of carbon and hydrogen. Tetsuro KÔNO, Setsuko MIYAO, Michiko ISHII, Keiko SATÔ, Mizue SUZUKI and Ikuko ISOBE (Journ. Agr. Chem. Soc. Japan **29**, 631-5, 1955)

Seasonal variation of the results in the micro determination of carbon and hydrogen was discussed statistically from the results of test analyses. The accuracy (standard deviation) of the micro-balance used was $\hat{\sigma}_W \div 2\,\mu g$; sucrose of 2-4 mg was used chiefly as the test material and carbon and hydrogen were determined after the method of Pregl with some modifications using the automatic controlled combustion apparatus previously reported (c.f. Kôno et al: Japan Analyst. **3**, 224 (1954)). Results for carbon on 406 analyses during two and half years showed a good consistency with the calculated value, i.e. mean error was $+0.025\%$ and the standard deviation was $\hat{\sigma}_C\% = 0.15\%$. Although no special care for the air conditioning was taken, yet any seasonal variation of the data was not observed, i.e. mean error of each month was within $\pm 0.1\%$. The data suggested the possibility that the sample might absorb humidity on sultry days while it was being weighed. Results for hydrogen on 108 analyses during one year showed a good consistency with the calculated value on the whole, i.e. mean error was -0.03%, but the standard deviation of the errors was $\hat{\sigma}_H\% = 0.19\%$, and even more, the mean value was about 0.1% larger in summer and about 0.1% smaller in winter. The discrepancy of the data in summer and winter might be attributed to the himidity introduced in the combustion tube at the exchange of the platinum boat, as it had been pointed out by MITSUI (Japan Analyst. **1**, 130 (1952)). But even so, the statistical data showed that the determination of carbon and hydrogen was fairly satisfactory.

22. Micro determination of oxygen in organic compounds. Part 3. A temperature-stabilizer for the long furnace. Tetsuro KÔNO, Keiko SATÔ, Mizue SUZUKI and Ikuno ISOBE. (Journ. Agr. Chem. Soc. Japan **29**, 936-8, 1955)

SHÖNIGER's apparatus to keep the temperature of the high temperature-long-furnace constant was modified as shown in Fig. 1. Furnace B (about 200°), with a bimetal switch, was connected parallely with the high temperature furnace (furnace A). The electricity was applied to the taps of 0-100 V and 0-120 V of the slide regulator alternatively so as to keep the temperature of furnace B and, consequently, that of furnace A constant, by the works of the bimetal- and micro-switch. As the result, the temperature of furnace A was kept constant even when the in-put voltage fluctuated between 95 and 105 V. The ripple of the temperature at 1100° was about ±5°, and the durability of the apparatus was more adequate than that of SCHÖNIGER's.

Part IV. Prevention of the fluctuation of the blank values. Tetsuro KÔNO, Keiko SATÔ, Mizue SUZUKI and Ikuo ISOBE (Ibid. **29**, 938-42, 1955)

The fluctuation of the blank values, in the determination of oxygen was reduced by refining the analytical conditions by use of a constant-pressure-nitrogen-tank, a flow-meter and the temperature-stabilizer above mentioned. The sample was pyrolized automatically and the products were swept in a stream of nitrogen, streaming at a

rate of 10 ml/min, in 30 min. The temperature of the carbon filling was kept 1100° ±5°. The average blank values were 20 and 32 μg, calculated as oxygen in 300 ml of nitrogen, at separated determinations. The standard deviations of them were 4 μg in both cases, i.e. about one half as large as that in the previous determinations (c.f. Kôno et al: Journ. Agr. Chem. Soc. Japan, **28**, 804 (1954)). The sizes of blank values compared favourably with the data of other workers.

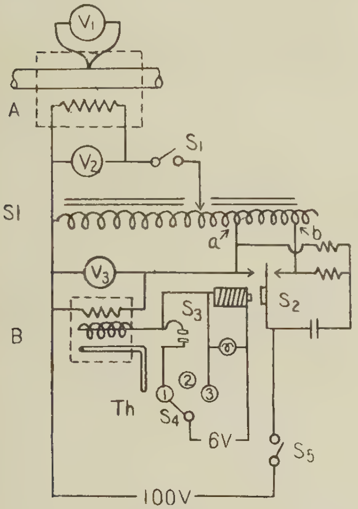


Fig. 1. A stabilizer for the high temperature furnace.

A: High temperature furnace,
B: Low temperature furnace with a bimetal switch,
$S_{1\sim5}$: Switch (S_2: Micro switch),
V_1: Thermo-couple.
V_2, V_3: 150 V A.C. meter,
a: 100 V tap,
b: 120 V tap,
Sl: slide regulator,
Th: Thermometer.

Part V. A new method for the determination of oxygen by the use of a silver-net-roll. Tetsuro Kôno, Keiko Satô, Mizue Suzuki and Ikuko Isobe (Journ. Agr. Chem. Soc. Japan **29**, 942-6, 1955)

A new method for the determination of oxygen was proposed, in which a silver-net-roll was used to catch the iodine liberated from the following equation.

$$1/2\,O_2 + C \rightarrow CO$$

$$15\,CO + 2\,HI_3O_8 \rightarrow 15\,CO_2 + H_2O + 6\,I$$

Anhydroiodic acid (HI_3O_8) was prepared in the following way: Iodine pentaoxide (I_2O_5) was dissolved in a little quantity of water and the solution was filtered while it was hot. Conc. HNO_3 was added to the syrup at room temperature to give 68 v/v % solution. The solution was heated at 100° for 1 hr., and the crystalls appeared were collected. A silver-net-roll of 5 cm long was used at 400–450° to catch iodine, the treatment of it was the same as that mentioned in the determination of sulfur and halogens (c.f. Kôno et al: *Journ. Agri. Chem. Soc Japan* **29**, 560 (1955)). Several test materials were analysed satisfactorily by this method. The method was simple, and had fair accuracy since 1 mg of iodine corresponds to 0.3152 mg of oxygen.

23. Metabobism of pyrrolidone carboxylic acid by bacteria. Yoshiharu Maruyama and Masayasu Nomura (Journ. Biochem., **43**, 327-335, 1956)

Several strains of microorganisms, which grow well on the medium containing

pyrrolidone carboxlic acid as a sole source of carbon and nitrogen, have been isolated from soil.

Using one of them, aerobic decomposition of pyrrolidone carboxylic acid was studied. As the decomposition products by washed cell suspension, glutamic acid, succinic acid, acetic acid and other organic compounds were detected.

The cell-free preparation, which can oxidize pyrrolidone carboxylic acid completely, was obtained from this organism.

The first stage of the oxidation of pyrrolidone carboxylic acid was concluded to be neither hydrolysis to glutamic acid nor decarboxylation to pyrrolidone.

A possible pathway (via pyroglutaramic acid) was discussed.

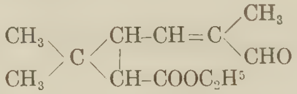
24. Studies on chrysanthemic acid. Part 3. Oxidation and reduction products of chrysanthemic acid. Masanao MATSUI, Kyôhei YAMASHITA, Masateru MIYANO, Seiichi KITAMURA, Yoshio SUZUKI and Michiko HAMURO (Bull. Agr. Chem. Soc. Japan **20**, 89, 1956)

Several oxidation or reduction products of dl-cis- and dl-trans-chrysanthemic acid were obtained and characterized. Oxidation by potassium permanganate, of dl-cis-chrysanthemic acid afforded dl-cis-dihydroxychrysanthemic acid (m.p. 240°). dl-trans-Chrysanthemic acid underwent the same oxidation and afforded two enantiomorphic dihydroxy acids which melted at 144° and 180° respectively. Ethyl dl-cis-chrysanthemate or dl-cis-chrysanthemoyl chloride was reduced with lithium aluminum hydride to the corresponding alcohol (b.p. 91–2°/8 mm, n^{22}_D 1.4594) which was named dl-cis-chrysanthemol. dl-trans-Chrysanthemol was obtained also with an analogous reaction (b.p. 110–111°/28 mm, n^{25}_D 1.4699). Catalytic reduction of dl-cis-chrysanthemic acid after absorption of one mole. of hydrogen gave dl-cis-dihydrochrysanthemic acid (m.p. 54°) (in the presence of platinum oxide or palladous oxide or Raney nickel catalyst), and after two mole. of hydrogen afforded β,γ-diisopropyl n-butyric acid (m.p. 69–71°) (in the presence of Raney nickel catalyst).

Synthesis of dl-trans-δ-chloro-dihydroxychrysanthemic acid, dl-cis-chrysanthemyl-dl-cis-chrysanthemate, dl-allylrethronyl-dl-cis-chrysanthemyl ether, dl-allylrethronyl-dl-trans-chrysanthemyl ether and dl-cis-chrysanthemyl bromide are described.

Part 4. Synthesis of chrysanthemum-dicarboxylic acid from chrysanthemic acid. Masanao MATSUI, Masateru MIYANO and Kyôhei YAMASHITA (Proc. Japan Academy **32**, 353, 1956)

Ethyl chrysanthemates (dl-cis-, dl-trans- and natural d-trans; all of them were chemically synthesized already.) underwent the selenium dioxide oxidation and afforded the corresponding aldehyde esters (I) (dl-cis: b.p. 140–145°/17 mm, n^{21}_D 1.4994, 2,4-dinitrophenylhydrazone melted at 192°; dl-trans: b.p. 135–145°/11 mm, n^{20}_D 1.4956, 2,4-dinitrophenylhydrazone melted at 157°; d-trans: boiled at 135–145°/11 mm, n^{19}_D 1.4970, 2,4-dinitrophenylhydrazone melted at 116°).



(I)

Chrysanthemic dicarboxylic acids were obtained upon the silver oxide oxidation of the aldehyde esters. dl-cis- and dl-trans-Chrysanthemumdicarboxylic acid melted

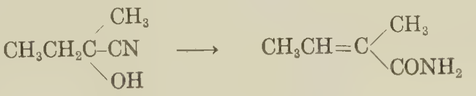
at 204° and 200° respectively. dl-trans-Chrysanthemumdicarboxylic acid thus obtained melted at 163–4° and was identical with natural chrysanthemumdicarboxylic acid.

Part 5. A synthesis of cis-coronic acid. Masanao MATSUI and Masateru MIYANO (Bull. Agr. Chem. Soc. Japan **20**, 135, 1956)

cis-Caronic acid was prepared by the condensation of methyl α, β-dibromoisovalerate with diethyl malonate followed by hydrolysis and decarboxylation. Ethyl acetacetate or ethyl cyanoacetate was also available in place of malonic ester. Besides cis-caronic acid, isopropylidenesuccinic acid and isopropenylsuccinic acid were found in the reaction mixture, however, no trans-caronic acid was detected in any case.

25. Calcium borohydride reduction of β-ketoesters. Masanao MATSUI, Masateru MIYANO and Kiyoshi TOMITA (Bull. Agr. Chem. Soc. Japan **20**, 139, 1956)

Lavile β-ketoesters were found to be smoothly reduced with calcium borohydride into the corresponding hydroxy acids which were identified as α, β-unsaturated acid after saponification and dehydration. Calcium borohydride was prepared by the addition of excess calcium chloride in methanolic sodium borohydride solution and was used without further purification. Crotonic acid and tiglic acid, for example, were obtained from ethyl acetacetate and ethyl methylacetacetate respectively by this method. A simple and convenient preparation of the latter products are also described, which consists in isomerizing dehydration of methyl ethyl ketone cyanohydrin with concentrated sulfuric acid in the presence of sulfur, giving the unsaturated amide (I), following alkaline saponification of the amide.


(I)

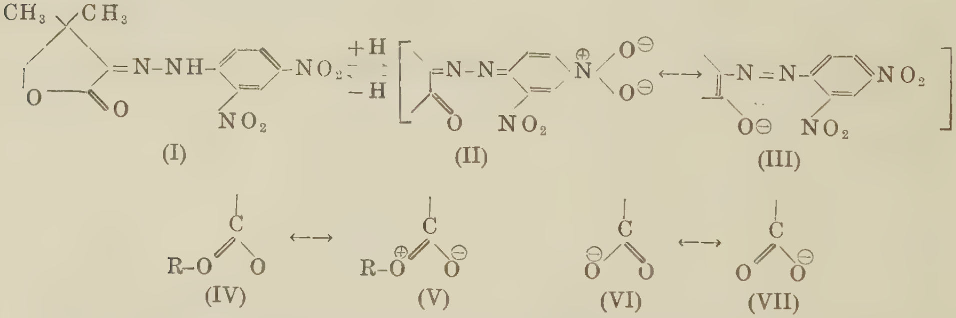
26. Studies on the microbial biosynthesis of pantothenic acid. Part 1. The presumption of the biosynthetic pathway of pantothenic acid by the inhibition analysis. Akira MATSUYAMA (Journ. Agr. Chem. Soc. Japan **29**, 730-735, 1955)

The scheme of the biosynthesis of pantothenic acid has been studied by the method of inhibition analysis. The effects of 44 metabolites on the actions of three specific inhibitors of pantothenic acid synthesis by *E. coli* and *B. subtilis* are indicated. As the specific inhibitors, DL-valine in the presence of phenol, L-leucine in the presence of benzoic acid, and salicylic acid are employed. It is found that β,β-dimethylpyruvic acid, a precursor of valine, is a noncompetitive antagonist to the three inhibitors as well as pantoic acid, α-ketopantoic acid and their lactones, while β-alanine is not. Therefore, the pathway of pantothenic acid synthesis in microorganism is presumed to involve the following reaction.

β,β-dimethylpyruvic acid→α-ketopantoic acid→pantoic acid. α-Hydroxyisovaleric acid is also found to be noncompetitively antagonistic and β,β-dimethylacrylic acid not antagonistic. The former may be utilized to pantothenic acid synthesis after conversion into β,β-dimethylpyruvic acid.

Part 2. Determination of pantoic acid and its precursors (No. 1.) Akira MATSUYAMA (ibid., **29**, 736-742, 1955)

α-Ketopantoic acid, a precursor of pantoic acid, is easily lactonized in the acidic solution quantitatively and the 2,4-dinitrophenylhydrazone (KPL-DNP) is colored (λ_{max}~515 mμ) in polar solvents by the addition of ammonia water or gas. This new color reaction has been examined so as to utilize it for the estimation of α-ketopantoic acid. The results are as follows: (1) Physical properties and analyses of the geometrical isomers of KPL-DNP are shown. (2) The absorption curves of these isomers are shown. Relationships between the volume of ammonia water, hours after ammonia water addition, amounts of KPL-DNP and absorbances (~350 mμ and ~515 mμ) are indicate. (3) This color reaction is due to the formation of the conjugated anion by removal of the proton from Compound (I). In the resonance structures (II and III) for the anion, only the movement of a charge is involved, and the low energy of the transition is responsible for the deeper color (λ_{max}~515 mμ) in comparison with that of the undissociated Compnuod (I). As the proton cannot be easily removed from the *syn*-isomer for hydrogen bonding rather than from the *anti*-isomer, the former is considered to be more weakly colored by ammonia. This result can be explained as the cross conjugation effect by the resonance structures of esters (IV)⟷(V) or free acids (VI)⟷(VII). The 2,4-dinitrophenylhydrazone of formaldehyde is not colored.



Part 2. Estimation of pantoic acid and its precursors (No. 2) Akira MATSUYAMA (ibid., **29**, 820-826, 1955)

The estimation of pantoic acid (PA) and its precursors contained in the enzymatic reaction mixture was studied.

(1) α-Ketopantoic acid (KPA) was determined by means of the specific color reaction of 2,4-dinitrophenylhydrazone of α-ketopantolactone (KPL-DNP), with ammonia water (cf. Part 2 No. 1). The conversion of α-ketopantolactone (KPL) to KPL-DNP was promoted by the addition of hydrochloric acid and especially ethanol. The condition of the quantitative formation of KPL-DNP and the standard curve for determination are shown.

(2) β,β-Dimethylpyruvic acid (DMPA) was determined by measuring the red color due to the alkalinized 2,4-dinitrophenylhydrazone of DMPA. The standard curve is shown. The steric structure of DMPA-DNP was assigned to the *syn*-configuration from the infra-red absorption spectra data and the difficulty of isomerization to an

anti-isomer may be attributed to the effects of steric hindrance caused by the terminal methyl groups of DAMPA-DNP molecule.

(3) The total amount of KPA and PA was determined by the color reaction of KPL and pantolactone (PL) using 2,7-naphthalenediol reagent. The standard curves are shown.

(4) R_F values of pantothenic acid precursors and their related compounds are shown.

Part 3. The biosynthesis of α-ketopantoic acid and pantoic acid by the cell suspension and cell-free extracts of *E. coli*. Akira MATSUYAMA (ibid., **29**, 973-977, 1955)

The enzymatic formation of α-ketopantoic acid from β, β-dimethylpyruvic acid and formic acid by the cell suspension and cell-free extracts of *Escherichia coil* was shown, and further confirmation was made by means of paperchromatography of the enzymatic reaction mixture.

(2) As the cofactors of this reaction leucovorin, pyridoxal, $V.B_{12}$ and ATP were effective.

(3) It was presumed that the function of folic acid derivatives in one-carbon transfer was attributable to their labile formyl group, and the stages requiring both pyridoxal and $V.B_{12}$ or each individually, differed from those catalyzed by folic acid derivatives.

(4) ATP might be probably necessary in the reaction $FAH_4 \rightarrow FAH_4$-CHO.

(5) As one-carbon source of this reaction formic acid was more effective than formaldehyde or methanol.

Part 4. Spectroscopic study on 2,4-dinitrophenylhydrazone of α-ketopantolactone (No. 1 and No. 2). Akira MATSUYAMA (Journ. Agr. Chem. Soc. Japan **29**, 977-85, 1955)

The ν_{N-H} bands in the infra-rew absorption spectra of the 2, 4-dinitrophenylhydrazone of α-ketopantolactone (KPL-DNP) have been studied, and the results obtained are as follows:

(1) In the region 3500–3000 cm^{-1} each KPL-DNP isomer has three or four absorption bands at ~3300 cm^{-1}, ~3200 cm^{-1} and ~3100 cm^{-1}. As the strongest band of isomers A and B appears at ~3300 cm^{-1} and ~3200 cm^{-1}, respectively, isomer A may be assigned as the *anti*-form and isomer B the *syn*-form.

(2) From the spectra in the dilute carbontetrachloride solution, it is indicated that all of these bands are not to be affected by the intermolecular hydrogen bonding.

(3) band of KPL-DNP at ~3100 cm^{-1} is the aromatic ν_{C-H} band.

(4) The absorption by KPL-DNP in the dilute carbontetrachloride solution is obserbed to be markedly affected by heating (60°, 30 min.); the band at ~3300 cm^{-1} disappeared, and that at ~3030 cm^{-1} appeared. These phenomena are considered to be the formation of the intramolecular hydrogen bond N..H—O resulting from the proton transition.

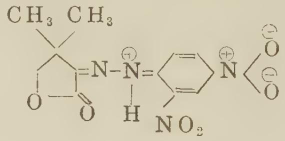
(5) The *anti*-isomer band at ~3200 cm^{-1} may be presumed from the N-H bond substituted with strong electron attracting groups possessing 2-NO_2, and also from dipicrylamine etc,—organic compounds with this N-H bond.

Concerning both $\nu_{C=O}$ bonds in the infrared absorption spectra and the ultraviolet absorption maximum of KPL-DNP, the results obtained are as follows:

(1) In the region 1800–1700 cm^{-1} each KPL-DNP isomer show splitting bands. With the solution spectra, $\nu_{C=O}$ bands appear at 1775 cm^{-1} and 1745 cm^{-1}.

(2) In comparison with the spectra as Nujol mull, absorption at 1745 cm^{-1} with *anti*-isomer and 1775 cm^{-1} with *syn*-isomer weakens relatively in chloroform solution and strengthened in pyridine solution. From these facts the relationship between one of the splitting bands and the polarity of solvents may be suggested. Therefore, the splitting of $\nu_{C=O}$ bands may be attributed to the intermolecular interaction.

(3) In the utlraviolet absorption spectra, a shift of the baximum of KPL-DNP (near 350 mμ) toward longer wave length in the polar solvents is observed. Thus, the quinoid structure (I) probably contributes to the excited state of this compound.



(I)

27. Studies on the microbial growth. Part 11. Effect of cysteine on the growth of *E. coli*. (No. 1). Akira MATSUYAMA (Journ. Agr. Chem. Soc. Japan **30**, 149-153, 1956)

(1) Effects of L-cysteine and other thiol compounds on the growth of *E. coli* in Koser's synthetic medium containing glucose as the carbon source are illustrated. The stimulatory effect of thiourea is abolished by substitution of its hydrogen on the S atom with the methyl radical. Influences of such mild reductants as $Na_2S_2O_3$ are are similar to those of thiol compounds. Effects of changing atmospheric pressure on the growth of *E. coli* in media containing L-cysteine are shown. These facts suggest that effects of L-cysteine and other thiol compounds may be attributable to the function of these substances regulating the oxidation-reduction potential of the media.

(3) The consumption of glucose by the growing cells of E. coli is stimulated by the addition of thiol compounds, while the consumption of pyruvic acid is inihbited.

(2) Effects of L-cysteine in media containing various monosaccharides and organic acids as the carbon source on the growth of *E. coli* are shown. These results indicate that effects of thiol compounds are different depending on the carbon sources of the media which are classified into two proups, glucose type and pyruvic acid type.

Part 11. Effect of cysteine on the hrowth of *E. coli* (No. 2). Akira MATSUYAMA (ibid., **30**, 153- 158, 1956)

(1) The effect of cysteine on the growth of *E. coli*, which had been reported in the previous paper, was studied in relation to the oxidation-reduction equilibra of the media. The fact that there were two types of carborn source in the media, i.e. glucose type and pyruvic acid type, in concerning with effects of thiol compounds was explainable by the difference of optimal Eh values for the consumption of the substrate between stages before and after pyruvic acid formation. This view was supported by experiments examining the relationship between the substrate-*E. coli*-oxidation-reduction indicator systems.

(2) Quantitative evaluation of antagonism between thiol compounds and mercuric chloride was made by the growth of *E. coli.* The results obtained with the aid of the curve showing lag-concentration of thiol group indicated that the antagonistic ratio was SH 2 mol/$HgCl_2$ 1 mol in the unheated medium over the wide range of $HgCl_2$ concentration.

28. Biochemical studies on "Bakanae" Fungus. Part 34. Isolation of gibberellins and their properties. Nobutaka TAKAHASHI, Hiroshi KITAMURA, Akira KAWARADA, Yasuo SETA, Makoto TAKAI, Saburô TAMURA and Yasuke SUMIKI (Bull. Agr. Chem. Soc. Japan **19**, 267-277, 1955) **Part 35. Relation between gibberellins, A_1, A_2 and gibberellic acid.** Akira KAWARADA, Hiroshi KITAMURA, Nobutaka TAKAHASHI, Makoto TAKAI, Saburô TAMURA and Yasuke SUMIKI (ibid., **19**, 278-281, 1955)

It has been confirmed that gibberellin is a mixture of three components, Gibberellin A_1 $C_{19}H_{24}O_6$ m.p. (decomp.) 232–5°, gibberellin A_2 $C_{20}H_{28}O_6$ m.p. (decomp.) 235–7°, gibberellic acid (namely gibberellin X and A_3) $C_{19}H_{22}O_6$ m.p. (decomp.) 233–5°, by treating their methyl ester through the chromatography on Al_2O_3 column.

Attempts to separate them in free acid form were made. The physical and chemical properties are described. Some results different from the previous report on acid degradation and catalytic reduction studies of these components were obtained. From gibberellin A, only gibberellin C $C_{19}H_{26}O_7$ m.p. (decomp.) 252-3°, from gibberellic acid only gibberic acid $C_{18}H_{20}O_3$ m.p. 153–4° and from gibberellin A_2 other acids were obtained. By catalytic reduction, gibberellin A_1 methylester absorbed one mole. of hydrogen, giving a dihydrogibberellin A_1 methyl ester, while gibberellic acid methyl ester absorbed two moles. of hydrogen, giving a tetrahydroderivative as an oily substance, but gibberellin A_2 did not absorb.

In addition to this, some experimental results of gibberellin A on animal tissues are also presented.

29. Selective cleavage of α-glucosidic linkage in starch using chemical agents. Part 1. Keisuke HORITSU (Journ. Agr. Chem. Soc. Japan **29**, 887, 1955)

Various studies upon the enzymatic action on starch have been carried out and several specific hydrolytic products were identified. But when acids were used in the place of enzyme, most of the end product was found to be D-glucose.

This study was undertaken to clarify whether the selective cleavage of starch would occur by means of mineral and organic acid or their esters, as catalysers, resulting in the production of a certain length of α-1, 4-gluocisidic linkage from amylose, and hydrolysis on only the branching point of the α-1, 6-glucosidic linkage of amyloepctin.

The present paper deals with the hydrolysis of amylose and amylopection by hydrochloric, sulfuric, phosphoric and glutaric acids. The results are as follows:

(1) It is impossible to find specific property in the individual catalysers, namely hydrochloric, sulfuric, phosphoric and glutaric acids, under the following given condition: (1) substrate concentration, 1.0%, (2) catalyser concentration, pH 2.1~2.3 and 3.1~3.7 and (3) reaction time 52 hours under the condition of shaking in a boiling water bath. The substrate used were amylose (potato) and amylopectin (potato).

(2) Recombination reaction of the glucose did not occur in the above conditions (sulfuric acid).

(3) It is noteworthy to have found that there was no significant difference between the two substrates, amylose and amylopection, in the course of hydrolysis.

(4) Difference in the production of monosaccharide, disaccharide and trisaccharide between the catalysers usd was not considerable.

(5) In regard to kinetics of the hydrolysis, it will be better to consider this acid-catalysed reaction as a "first order reaction" on the average.

30. Studies on reticulo-rumen digestion. Part 2. The artificial culture of some entodinia (I). Makoto KANDATSU and Naomi TAKAHASHI (Journ. Agr. Chem. Soc. Japan **29**, 833-838, 1955)

Numerous protozoa exist in the ruminant, belonging to ciliata and are moving in an active state. In order to cultivate the ciliata artificially, several experiments were undertaken and results obtained are as follows.

The rumen ciliata (Infusoria) was obtained through a permanent fistula from goat's rumen with its content and concentrated by gentle centrifugation after straining of the content through a double surgical gauze.

Species of *Entodinium* were the most among the rumen ciliata of the goat, so we have treated these species mainly, as the subject of cultivation.

(1) Infusoria can be alive 'in vitro' for 100–120 hrs. in the rumen liquor requiring the coexistence of bacteria.

(2) The rumen liquor can be replaced by the hay extract medium, which is prepared by extracting the hay with RINGER's solution and then incubated with the bacteria of goat's rumen for 3 days.

(3) There is one necessary factor for the cultivation of Infusoria in the rumen liuqor and this is produced in the hay extract medium by the rumen bacteria after about 3 days of incubation.

(4) The effectiveness of the factor may be almost entirely destroyed by heating at 60° for 10 minutes.

(5) The survival time of Infusoria varies with the species of bacteria in the culture medium.

Part 3. On the artificial culture of some *Entodinia* (II). Makoto KANDATSU and Naomi TAKAHASHI (ibid., **29**, 915-918, 1955)

Following the previous report, the experiments on the artificial culture of Infusoria from goat's rumen have been undertaken. The life span of Infusoria, including Entodinia mainly, studied here, can be extended for about twenty days in vitro by addition of fresh white clover leaves at an amount of 5–6% to the hay-RINGER's extract culture medium, which is inoculated with rumen bacteria and incubated for 3 days.

It is observed that Infusoria are in an actively motile state and have frequent fission.

Infusoria cannot survive at various concentrations of the clover juice in the absence of the other essential factors.

These effects of fresh white clover leaves on Infusoria cultures are not due to

their inorganic substances.

When the fresh clover leaves are heated at 100° for 30 minutes, they do not forfeit their properties. So, it may be assumed that the effective factor of the clover leaves is a thermostable one. The same effective factor also exists in green peas and spinach leaves.

Part 4. On the artificial culture of some *Entodinia* (III). Makoto KANDATSU and Naomi TAKAHASHI (ibid., **30**, 96-99, 1956)

The artificial culture of goat's rumen Infusoria which belong to the oligotrich ciliata havę been studied.

Infusoria can survive for 5–7 days at various concentrations of the rumen liquor, and for 10–14 days by the addition of the fresh white clover leaves into the culture medium.

The life of Infusoria which include species of *Entodinium caudatum, E. longinucleatum,* and *E. simplex,* can be extended for more than 30 days 'in vitro' by the addition of the fresh white clover leaves at the amount of 5% to the hay-salt solution extract culture medium which is incubated with rumen bacteria for 24-48 hrs. at 38° with vitamin B_{12} added.

It is observed that when the culture medium is renewed at intervals of 48 hrs., Infusoria are in an actively motile state and have a frequent fissino which multiplies to numbers of 50,000 organisms per ml medium.

Vitamin B_{12} is not effective for these protozoa when it is supplemented without fresh clover leaves.

Part 5. Cobalt contents in the feeds. Makoto KANDATSU and Bunpei MORI (ibid., **30**, 100, 1956)

Several workers have suggested that the function of cobalt in the ruminant nutrition relates to the activities of microflora probably through some mechanism in the forestomach. As one concerned in the studies of reticulo-rumen digestion, the cobalt content of the feed in Japan was determined by polarographic and colorimetric methods, with Nitroso R salt, concerning the microflora activities in the rumen.

Results obtained are as follows.

(1) The determination of cobalt content has been carried out on about 30 samples of indigenous feed, several factors affecting the determination being examined.

(2) Results obtained by the two methods were consistent very closely.

(3) The cobalt content of indigenous feed were within 20–80 γ/100 g dry bassis the range of which is in the same order with those reported in foreign countries, no sample with an extremely low cobalt content being found among the feeds examined.

31. On the relation between nitrogen balance and liver xanthine oxidase. Makoto KANDATSU and Michio YAMAGUCHI (Journ. Jap. Soc. Food and Nutrition **8**, 261, 1956)

The relation between nitrogen balance and liver xanthine oxidase activity was studied by using arbino rats fed on protein-free diet. The duration of the experimental feeding was 4, 8, 12 and 16 days respectively.

After 12 days xanthine oxidase activity was diminished to the extent of zero level, while body weight and total liver nitrogen content to the extent of only about

90% and 50% of the initial value respectively.

Although the diminution of liver xanthine oxidase activity was generally not proportionate to the values of nitrogen balance 2 and 4 days before dissection, the relations between the total activity and the value of nitrogen balance for 2 days was tolerably linear.

On the other hand, both unit and total activity had close negative correlation to the total amounts of nitrogen balance which were summed up during the experimental feeding, especially to the ratioes of the total amounts of nitrogen balance to both the initial body weight and the amount of nitrogen balance at the stock diet respectively. From the relation above mentioned we attempted to calculate, by using regression line, how much body protein was lost when liver xanthine oxidase activity diminished to the extent of zero level, and came to such inference that the loss of body protein was about 2% of the initial body weight.

32. Studies on the analytical method of composition of foods and fodders. Part 3. On the rapid procedure for the determination of true protein in starchy foods. Makoto KANDATSU and Tamio SATOW (Journ. Jap. Soc. Food and Natrition **8**, 135, 1955)

We made a study to investigate on a rapid procedure for the determination of true protein in starchy foods, since the filtration of protein precipitate is very difficult and time consuming. The proceudre of our method obtained is as follows:

Take 1 gram of sample into a conical flask, and add 20 cc of 5% formic acid, then fit the flask with a reflux condenser. Heat the mixture for half an hour in the water bath. Cool and the contents of the flask is neutralized with dilute sodium carbonate or dilute sodium hydroxide solution. Then add 25 cc of cupric sulfate solution and sodium hydroxide solution and shak well. The reaction mixture is allowed to stand over night. A clear supernatant fluid is decanted until the reaction of $Cu^{\cdot\cdot}$ or SO_4'' in the filtrate disappears. The washed protein precipitate is then transferred to a Kjeldahl flask with filter paper and the nitrogen content is determined by the Kjeldahl method.

The result obtained by our method agreed well with that obtained by other standard methods, and the time required for analysis by our method can be shortened from ½ to 1/10 of the usual method.

This rapid method is applicable generally to true protein determinations of starchy foods and fodders except sweet potato.

Part 4. Quantitative determination of reducing sugar by LANE and EYNON's method with magic-eye as external indicator. Makoto LANDATSU and Tamio SATOW (Journ. Agr. Chem. Soc. Japan **30**, 322, 1956)

A electrometric titration apparatus for the quantitative determination of reducing sugar by the LANE and EYNON method with magic-eye as external indicator is described.

This apparatus will allow 25 volts of voltage variations at original allernating current line any perceptible change in the operating shadow of the magic-eye.

Titration by magic-eye indicator is simpler and less time-consuming than the usual method with methylene blue as internal indicator or electrometric method with galvanometer as external indicator and can be applied to coloured sample solutions.

Furthermore the possibility of observing the approach of end point makes the determination of end point more accurate. But the cell must be allowed to stand for several hours to saturate the plug, and the plug and the cell liquid cannot be permanently used for analysis.

33. On the protein precipitant for the determination of true proteins in foods and fodders; protein precipitabilities in 10% NaCl solution by trichloroacetic acid. Makato KANDATSU, Tadahiko YASUI and Noriko YAMAMOTO (Journ. Agr. Chem. Soc. Japan **30**, 316, 1956)

In our previous experiments, it was found that the precipitatable nitrogen in 10% NaCl soluble fraction of leafy vegetables by trichloroacetic acid was very small to the total nitrogen. To make this fact clear, we have studied on the protein precipitatabilities in 10% NaCl solution by trichloroacetic acid. The results obtained were as follows:

(1) At the precipitation of Glycinine and Edestine in 10% NaCl solution by trichloroacetic acid, the former was precipitated 96% by 8 or more per cent acid solution and the latter was done 100% by 2.5% acid solution, and also it was not recognized the differences between the amount of protein precipitate by washing with one or more per cent acid solution, but the precipitate should not wash with water. The fact found above shows that the higher concentration of NaCl solution do not inhibite the protein precipitatabilities by trichloroacetic acid.

(2) No inhibitor for the precipitatabilities of Glycinine and Edestine in the 10% NaCl soluble fraction of leafy vegetables was found. Therefore, the non-precipitatable nitrogen in this fraction by trichloroacetic acid indicated the non-protein nitrogen compounds.

(3) To determine the true proteins in 10% NaCl soluble fraction of leafy vegetables by trichloroacetic acid, we should employ at least 2.5% acid solution as protein precipitant, and the 2 per cent acid solution for washing.

34. On the preparation of thiamine sales. (II) Preparation of aromatic sulfonates of thiamine and oxythiamine. Kengo OKUMURA and Yosito SAKURAI (Vitamin **10**, 5, 1956)

Water soluble disulfonates of thiamine were prepared by the exchange of anionic group of thiamine chloride hydrochloride with anion exchange resin, or by adding the aqueous solution of thiamine sulfato to the aqueous solution of barium sulfonate followed by the removable of barium sulfate resulted.

Disulfonates of thiamine and oxythiamine, both less soluble in water, were prepared by adding the aqueous solution of chloride hydrochloride of thiamine or oxythiamine to the aqueous solution of sulfonic acid or alkali sulfonate.

Monosulfonates of thiamine, less soluble in water, were prepared by adding the aqueous solution of thiamine mononitrate to the aqueous solution of alkali sulfonate, or by treating the solution of the corresponding thiamine disulfonate with barium carbonate.

35. Prebluda-McCollum rection on thiamine disulfide. Kengo OKUMURA, Yousuke ASANO and Yosito SAKURIA (Vitamin **11**, 1, 1956)

(1) Both disulfide type compounds and O, S-diacyl compounds of thiamine give

a considerable coloration in Prebluda-McCollum reaction.

(2) It was realized that Prebluda-McCollum reaction of the disulfide type compounds of thiamine is caused by the conversion of them to thiamine with alkali in the reagent.

36. Experimental studies on vegetable tanning in the laboratory. Yasushi SATÔ (Bull. Jap. Assoc. Leather Technology, **1**, 37, 1955)

(1) It is probably true in experience that the thin part of the hide adsorb or combine much more tannin than the thick part. This problem was proved experimentally using pine and mangrove tannin extract. The difference in percentage of adsorbed tannin in produced leather containing 18% moisture was 7.9% (pine), 6.1% (pine), and 3.3% (mangrove) respectively, and 5.4% in leather which was tanned by quebracho in a factory.

(2) The influence of changing pH of tan pit in the combined tannin was experimented using mangrove tannin extract. One is the case that the pH of tanning solution was changed from a low value to a high value, and the other is that from a high value to a low value. As a result, number of the leather produced in the latter condition was higher than that in the former.

37. Studies on milk coagulating enzymes. Part 2. The search for milk coagulating activities in various viscera of animals and in others. Tomokichi TSUGÔ and Makoto KOBAYASHI (Jap. Journ. Zootech. Sci., **26**, 173, 1955)

The milk coagulating activities in various viscera of rabbits were searched on extracts with 5% NaCl and 0.2% MCl solutions. The extracts had milk coagulating ability in the order of stomach, testicles, small intestines, heart and pancreas. The other viscera had no activity. As some coagulating activity was found in the testicles of rabbit, further search was carried out in the testicles of pig and sheep. However, their activities were very weak.

The milk coagulating activities in fruits and latex of fig (*Ficus carica*) were tested, and fig latex was found to have an especially remarkable activity.

The milk coagulating actions of fig latex and testicles (rabbit) were compared with those of rennet, pepsin and papain, and it was found that the action of the former was between rennet and papain, rather near to papain, and the later showed to have rennet-like property.

Part 3. On the milk coagulating action of fig latex and animal testicles. Tomokichi TSUGO, Kunio YAMAUCHI and Noboru MIYADAI (ibid., **26**, 177, 1955)

The milk coagulating function by enzymes in the fig latex (ficin) and by the extracts of the testicles of animal (rabbit, bull, and pig) were studied. The results are as follows:

(1) Ficin, especially fresh latex of fig, was very powerful in the coagulation of milk. Coagulating ability decreased by 50% during the process of alcohol precipitation and drying. It is desirable that the powder be stored in a dark, vacuum place.

(2) HCN, cysteine, $NaH_2PO_2 \cdot H_2O$ and $Na_2S_2O_3$ activated its coagulating activity. Phenylhydrazine and hydroxylamine activated at first and then inhibited when the weak enzyme was used. H_2O_2 remarkably inactivated milk coagulating action

of ficin.

(3) Milk Coagulating activity of ficin was relatively stable in high temperatures. Its optimum temperature was also higher than that of rennin. Heated, they showed the activating action on coagulation by ficin.

(4) Increase of acidity and Ca ion does not so much strengthen the activity of ficin as that of rennin. The milk, which was treated with rennet but the coagulation of which was stopped by the addition of oxalate, clotted by the action of ficin.

(5) The yield of protein clotted by ficin was somewhat less than that by rennet, especially when powerful ficin was used.

(6) Generally speaking, the extract of testicles had little or no ability to clot the normal milk (acidity 2.0 cc). When its proteolytic activity was measured on pig testicles by a colorimetric micro method for estimating peptic action, two optimum pH values were found (pH 1.9 and 4.0).

Part 5. Comparison of milk proteins coagulated by various milk coagulating enzymes. Rinjirô SASAKI, Tomokichi TSUGÔ and Kunio YAMAUCHI (Journ. Agr. Chem. Soc. Jap., **30**, 209, 1956)

The curd coagulated from skim milk by acid or milk coagulating enzymes (rennet, pepsin, papain and ficin) were compared electrophoretically under the same conditions (in phosphate buffer of pH 7.6, $\mu=0.09$, containing 0.08N NaCl). The actions of these enzymes on sodium caseinate solution were also compared by the same method.

The following results were obtained.

(1) The actions of rennet and pepsin on casein of skim milk or sodium caseinate solution had a close resemblance in every series of the experiments. In both curd of skim milk and sodium caseinate solution, rennet and pepsin were observed to cause heterogeneity in the region of α-casein.

(2) The curds coagulated from milk by papain or ficin were found to differ from those by rennet or pepsin considerably. A more stronger decomposition may be assumed from their electrophoretic paterns.

(3) Casein in milk and sodium caseinate solution may be different in its acceptability for the action of these vegetabel coagulating enzymes, as these enzymes could precipitate sodium caseinate solution at a much lower enzyme concentration than that at which they could coagulate milk. Whereas by rennet and pepsin, no visible precipitation occurred in sodium caseinate solution. Vegetable coagulating enzymes are considered to decompose casein more easily in sodium caseinate solution than in milk, from electrophoretic observation.

(4) Tre rennet curd prepared from acidulated milk with pH 5.1 was ont so different from acid casein, but considerably distinct from that or milk with pH 6.6 or 5.5 This suggests that the quailty of curd is related to acidity of milk from which the curd is prepared.

(5) Rennet and pepsin wheys were different from acid whey in the peak of β-lactoglobulin; β-lactoglobulin showed two peaks when these enzymes were used. In papain or ficin whey, however, there remained only one peak as in acid whey.

Part 6. On the break-up of casein by rennin and its relationship to milk coagulation. Rinjirô SASAKI, Tomokichi TSUGÔ and Kunio YAMAUCHI (ibid., **80**, 240, 1956)

Action of crystalline rennin on sodium caseinate solution was studied by various

methods, especially from the point of view of milk coagulation. Electrophoretic observation (in veronal vuffer of pH 7.3, $\mu=0.1$ and containing 0.08N NaCl) on casein treated with rennin at various time and then heated at 80°C for 10 minutes to stop the action of the enzyme showed the splitting of α-acsein at initial stages of rennin action. β-Casein was also found to split into two peaks when casein was treated with rennin for a longer time.

When milk coagulates, the change in casein caused by rennin agrees with the initial change in sodium caseinate solution; the region of α-casein splits into two peak but that of β-casein remains uniform.

Slight increase of trichloracetic acid-soluble nitrogen and decrease of viscosity by rennin were detectable in sodium caseinate solution. Both changes were comparatively rapid within initial time of reaction. Coagulability of sodium caseinate solution for calcium ion also changed papidly at first and then remained almost constant.

These changes are considered to be responsible for enzymatic conversion of casein into paracasein, especially electrophoretic splitting of α-casein must be concerned to the coagulation of casein in milk.

38. Studies on the chemical composition of raw stock of mammal's skin. I. On the condition for determining protein fractions. Yasushi SATÔ (Jap. Journ. Zootech. Sci., **26,** 183, 1955)

With the view of analysing compositions of protein fractions in raw stocks of mammal's skin, the condition of analysis in salt cured skin was investigated, which served as a reference to the leather manufacture.

And the following results were obtained in respect of the condition of analysis in the case that the size of sample was 2×2 cm~3×6 cm.

1. Saline soluble protein.

Five or more times the weight of sample of 10% NaCl Soln. should be used, and extracted two or three times by shaking at room temperature for two hours. This protein may be precipitated by adding 2.5% of trichloracetic acid.

2. Alkali soluble protein.

The conclusion could not be obtained.

3. Elastin and Reticulin.

After sample unhaired with lime was washed, it was brought into 10% acetic acid and boiled. It is supposed that the residue obtained after boiling was almost elastin.

Accordingly, the residue was washed wtih alcohol and ether, and weighed as elastin and reticulin.

4. Collagen and keratin.

Nitrogen in the part dissolved by boiling with acetic acid was measured and multiplied by 5.62. The value obtained is the weight of collagen.

Hair cut from the sample at the beginning of the experiment, and residual hair and epidermis removed with lime were washed together and weighed as keratin.

II. On the change of protein composition by curing and preservation. Yasushi SATÔ (ibid., **26,** 193, 1955)

In order to recognize the change of the composition of protein in salt cured skin

during preservation, compositions of two samples—one was preserved for 3 days, and the other for 110 days—were analysed and compared with each other statistically.

There were differences in compositions of soluble parts, and so the change of insoluble parts was very little and negligible.

It must be taken into consideration that the probable difference of protein weights between preservation for 3 days and for 110 days is about ±22% (on the analysed value) as to saline soluble protein and about ±34% as to alkali soluble protein.

Moreover, it was found that fresh skin lost about half saline soluble protein by salting, and the precipitated parts by tannic acid in soluble parts diminished during preservation.

III. Chemical analysis and determination of protein fractions of various raw stocks. Yasushi SATÔ and Yoshitaka KAKO (ibid., **26**, 207, 1955)

In order to recognize the composition of animal skin as raw material for leather and glue, chemical components of salt-cured hide and skin of the following mammals were analysed—cattle, steer, horse, rabbit, dog, pig, deer and kid. Samples were collected from the fore and hind shanks excepting rabbit.

Taking into consideration the results reported previously as to changes in composition of the skin during preservation, we noticed the following results.

Hide of the cattle, steer and horse keeps more moisture and contains less crude protein than that of the others. In protein composition, the former has more collagen and less keratin than the latter. The skin of the dog and pig has more fat than the others. Pig's skin has the least keratin and collagen. Dog's skin is almost the same with steer's so far as content of keratin and collagen is concerned. Generally, collagen content increases with the increase in thickness of the skin except in the case of the skin of pig and horse.

Taking into consideration the composition of the corium calculated, exclusive of moisture, ash and keratin, we noticed the following results.

Fat content is variable with a wide range, but is mostly in the span of 5∼15% except the skin of pig and dog, and is lower in the hide of cattle, steer and horse than in that of the others. Soluble protein content is especially low in pig's skin, high in kid's and deer's and 3∼5% in the others. Elastin and reticulin content is low in dog's and Pig's skin, high in Kid's skin and 3∼6% in the others. Collagen content is lowest in pig's skin, a little lower in kid's skin and 70∼80% in the others. In this case, the correlation between collagen content and thickness of the skin is not clear.

39. On the fat-globule membrane materials of cow's milk. Part 1. Isolation of membrane protein and its electrophoretic properties. Rinjirô SASAKI, Susumu KOYAMA and Michio NISHIMURA (Journ. Agr. Chem. Soc. Jap., **29**, 827, 1955)

The fat-globule membrane protein of cow's milk has been isolated, and its electrophoretic properties studied.

The cream was washed by diluting with nine volumes of 0.95% NaCl solution and reseparated after each dilution by means of a DeLaval cream separator. The fat-globule membrane protein was obtained after four washings.

The fat-globule membrane protein was compared with casein, whey-protein and

non-washed cream-protein on the basis of their electrophoretic properties.

Generally, 2 to 3 components were observed in the electrophoretic mobility pattern of the fat-globule membrane protein.

No positive identification of these components has been attempted from existing electrophoretic evidence, but the fat-globule membrane protein was provisionally classified as either whey-protein (other than β-lactoglobulin) or a protein with a whey-protein like nature.

Part 2. Absorption of radioactive Ca 45-caseinate and whey-protein to milk fat-globule. Rinjirô SASAKI and Susumu KOYAMA (ibid., **29**, 831, 1955)

The adsorption of Ca^{45}-caseinate and whey-protein on the surface of milk fat has been studied.

Pure butter fat was emulsified in each of the following two media resulting in a fat content of 3.5%: (1) a sol containing Ca^{45}-caseinate (pH 6.6, casein content 2.5%), (2) acid whey (neutralized to pH 6.6).

The emulsion was separated by means of a DeLaval cream separator, and the cream obtained was washed by diluting it with 9 volumes of 0.95% NaCl solution and reseparated after each dilution.

Results are as follows:

(1) Ca^{45}-caseinate was not detected on the surface of fat-globule after two washings.

(2) The paperelectrophoretic diagrams showed that β-lactoglobulin was washed out after two washings, but the other whey-protein components were still adsorbed on the surface of fat-globule after four washings.

From these experiments it is apparent that the fat-globule membrane protein of normal cow's milk does not contain Ca-caseinate.

It, therefore, seems probable that whey-protein components are contained in the fat-globule membrane protein of normal cow's milk.

40. On the germicidal action of cow's milk. Part 1. Evaluation of the pH response assay of germicidal action in milk. Rinjirô SASAKI and Kageaki AIBARA (Journ. Agr. Chem. Soc. Jap., **29**, 865, 1955)

Since the beginning of this century, many investigators have shown that fresh raw milk has a definite germicidal action which can be destroyed at the boiling point or by heating at 80°C for 2 minutes. The above action was specific and dependent upon both the cow and the species of bacteria employed. And a substance that showed germicidal action was called "lactenin" by JONES and SIMMS in 1930.

The test organisms used here in this experiment consisted of 12 strains and 1 human type strain of *Streptococcus pyogenes*, cultured in serum broth. The germicidal action of milk was estimated by its inhibitory effect on acid production of these organisms using the pH response as the criterion. One of these strains "Yugo" (animal type) was found to be most suitable for the pH response assay, and the optimum condition for the experiment was obtained by using the 4th generation of the culture.

A considerable variation among the cow's milk in its germicidal activity was found. In general, however, the most significant manifestation of the action could

be obtained after the heating of milk at 58°C for 20 minutes while its action was destroyed by heating over 70°C for 20 minutes. On the other hand, the fresh raw milk showed that the acid production of lactic acid bacteria surviving in the milk would overcome the germicidal action of the milk abovementioned, whose dose-response curve would not be apparent.

41. Studies on the activities of antibiotics against plant pathogenic microorganisms. Yoshihisa KOAZE, Heiichi SAKAI, Hiroshi YONEHARA, Masaru ASAKAWA and Tomomasa MISATO (Journ. Antibiotics, ser. A, **9**, 89, 1956)

(1) Effects of about 40 known antibiotics against about 20 important plant pathogenic microorganisms have been tested in vitro.

(2) Among these antibiotics, the followings exhibited strong activities: aureothricin and thiolutin for both fungi and bacteria, blasticidin A, eurocidine, rimocidin and trichomycin for only fungi and chlortetracycline, grasseriomycin, oxytetracycline, polymyxin B and tetracycline for only bacteria. It was noted that antimycin A had a strong action against a limited variety of fungi.

(3) The following plant pathogenes, *Fusarium, Gibberella* and *Erwinia,* were not affected even at high concentrations of many antibiotics, and *Ceratostomella, Elsinone, Piricularia* and *Xanthomonas* were sensitive to antibotics.

(4) In the same genus, the difference in antibiotic sensitivities was observed between species.

42. The determination of D-glutamic and D-aspartic acid content of malignant tumors and normal tissues by means of new oxidase. Shôji MIZUSHIMA, Kazuo IZAKI, Hajime TAKAHASHI and Kin-ichirô SAKAGUCHI (Gann, **47**, 91-95, 1956)

In looking for microorganisms for the purpose of studying the metabolism of D-amino acid, we found that the fungus belonging to *Aspergillus ustus* metabolizes D-glutamic acid considerably. When the fungus was grown in the medium containing D-glutamic acid as a sole source of nitrogen, its dried cell or the crude extract oxidized D-glutamic and 4-aspartic acids specifically and quantitatively according to the following equations;

$$\text{D-glutamic acid} + \tfrac{1}{2}O_2 \longrightarrow \alpha\text{-ketoglutaric acid} + NH_3$$
$$\text{D-aspartic acid} + \tfrac{1}{2}O_2 \longrightarrow \text{oxalacetic acid} + NH_3$$

This enzyme preparation was used for the determination of the D-glutamic and D-aspartic acid content of the hydrolysate of cancer and normal tissues. It has been shown that cancer tissues are not characterized by the presence of D-glutamic acid, as stated by Kögl.

43. Studies on the metabolism of D-amino acid in Microorganisms. Part 2. Oxidation of D-glutamic acid by a new enzyme of Mold. Shôji MIZUSHIMA, Kazuo IZAKI, Hajime Takahashi and Kin-ichirô SAKAGUCHI (Bull. Agr. Chem. Soc. Japan **20**, 36-41, 1956)

A new enzyme responsible for the oxidation of 4-glutamic acid was obtained from the mycelium of *Aspergillus ustus* strain 'f' isolated from the soil. Many properties of this enzyme in the state of dried cell or crude extract were studied. The enzyme preparation strongly oxidizes D-glutamic and D-aspartic acids but does not affect any

other DL-amino acids at all. A new micro-determination method for D-glutamic acid has been devised by means of this enzyme.

Part 3. On the presence of D-monoamino-dicarboxylic acid oxidase. Shôji MIZUSHIMA and Kin-ichirô SAKAGUCHI (ibid., **20,** 131-134, 1956)

In the previous paper it was reported that a mold enzyme preparation from *Aspergillus ustus* strain 'f.', which was found to oxidize D-glutamic acid specifically, was always accompanied by the oxidation of D-aspartic acid. The present study has been carried out to investigate whether or not D-glutamic and D-aspartic acids are oxidized by the same enzyme.

A highly purified enzyme preparation which still shows both activities has been obtained. Several evidences which support the assumption that both the reactions might be catalyzed by a single enzyme, which may be called D-monoamino-dicarboxylic acid oxidase, are also presented.

44. The determination of D-glutamic acid and D-aspartic acid by means of a new oxidase. Shoji MIZUSHIMA, Kazuo IZAKI, Hajime TAKAHSHI (Bull. Agr. Chem. Soc. Japan **20,** 178-182, 1956)

The fractional determination of D-glutamic and 4-aspartic acids using the oxidase preparation of *Aspergillus ustus* strain f. was studied.

In the first part of this paper, the procedure of enzyme preparation, the effect of sodium chloride and other inorganic salts on enzyme activity, and a new device for the fractional determination of D-glutamic and D-aspartic acids are described.

In the latter part, the content of D-glutamic and D-aspartic acids of cancer and normal tissues are estimated. However, it was found that the cancer tissues are not characterized by the presence of D-glutamic acid as claimed by Kögl.

45. Studies on the requirment of amino acids and vitamins of yeast. Part IV. Masahiro TAKAHASHI (Journ. Agr. Chem. Soc. Japan **30,** 140-145, 1596)

In the last report the author has reported that histidine inhibited the growth of yeast in a vitamin deficient-medium. Now the author made a study on the inhibition of histidine on the growth of yeast in varied concentrations. The inhibition of histidine to the growth of yeast come out from the concentration of 100 mg per liter in the vitamin deficient medium. This inhibition is disappeared by the addition of Ca-pantothenate or β-alanine in the concentration of 1 mg per liter.

On the other hand the growth of yeast is abnormal in the vitaminless-medium containing amino acid mixture as nitrogen source in spite that the *l*-histidine, *l*-arginine, *l*-glutamic acid, *dl*-serine, *dl*-isoleucine, *dl*-methionine, *l*-tyrosine, *dl*-valine and glycine are excluded owing to their inhibition of growth of yeast and therefore this abnormal growth depend on the lacking of vitamines.

Part V. Masahiro TAKAHASHI (ibid., **30,** 145.148, 1956)

Nitrogen assimilability of yeast depend on its inoculum size. So in the case of the determination of the nitrogen assimilability by yeast the experiments must be carried out in the same inoculum size. Sake yeast assimilate $(NH_4)_2SO_4$ as a nitrogen source better than other materials, except Koji extract under the condition

carried on inoculum size of 10^3/cc. High nutritive value of Koji extract are caused by means of several vitamins which are contained in the Koji extract.

46. Studies on the metabolism of D-amino acid in microorganisms. Part 1. Degradation of D-glutamic acid in the genus Aerobacter. Kazuo IZAKI, Hajime TAKAHASHI and Kin-ichirô SAKAGUCHI (Bull. Agr. Chem. Soc. Japan **19**, 233, 1955)

During the search for the microorganism, which can grow on the medium containing D-glutamic acid as a sole source of carbon and nitrogen, it was found that several isolated strains belonging to the genus *Aerobacter* can metabolize D-glutamic acid more rapidly than the L-form even when the organism is grown in DL-glutamic acid. In a typical experiment, D-glutamic acid is oxidized some ten times faster than L-form when one of the strains was grown aerobically in DL-glutamate medium. L-glutamic acid is successfully obtained from DL-form by decomposing D-glutamic acid using the strain. This may be the first observation on a natural amino acid obtained from the racemic one by the metabolic action of the organism. The strong oxidative activity of the strain towards 4-glutamic acid is produced when it is cultured aerobically in the medium containing D- or DL-glutamic acid, and decreases rapidly as soon as D-glutamic acid is consumed, while the cells grown in broth could hardly oxidize D-glutamic acid. These results may indicate that D-glutamic acid oxidase system involves an induced enzyme. The cells grown in DL-glutamate can hardly oxidize DL-methionine, which is the best substrate for Kreb's D-amino acid oxidase, while they oxidized DL-aspartic acid, but in a rate lower than D-glutamic acid.

Farthermore, it is observed that D-glutamic is rapidly oxidized, though L-glutamic acid is not. These observations strongly suggest the presence of a new oxidase, D-glutamic acid oxidase.

10^{-3}M of Arsenite inhibit D-glutamic acid oxidation almost completely, and 2, 4-dinitrophenyl hydrazone of α-ketoglutric acid is obtained from the incubation medium containing M/2000 Arsenite. It may be concluded that α-ketoglutaric acid is the primary degration product of D-glutamic acid.

47. Metabolism of D-glutamic acid in microorganism. Kazuo IZAKI, Shôji MIZUSHIMA, Hajime TAKAHASHI and Kin-ichirô SAKAGUCHI (Symposia on Enzyme Chem., Japan **11**, 143, 1955)

Oxidative metabolism of D-glutamic acid by microorganisms, isolated from soil and sewage was investigated. It was found that several isolated strains of bacteria belonging to the genus *Aerobacter*, metabolize D-glutamic acid more rapidly than the L-form, when they are grown either in D or in DL-glutamate media. The results obtained revealed the occurrence of a specific oxidase responsible for the oxidation of D-glutamic acid by the bacteria.

Partially purified enzyme preparation was obtained from the mycelium of *Aspergillus ustus* isolated by the authors from soil. It catalyzed the oxidation of D-glutamic acid according to the following equation;

D-glutamic acid $+O_2+H_2O \rightarrow$ α-ketoglutaric acid $+H_2O_2+NH_3$ The reaction is inhibited by KCN (10^{-3}M), PCMB. (10^{-3}M) and Ag^+(5×10^{-4}M). Appreciable activities towards other DL-amino acids could not be detected except towards D-aspartic acid.

There is some controversy as to whether D-glutamic acid and D-aspartic acid are activated by the same or by different enzymes. Work done by J. L. STILL established that the specific D-aspartic acid oxidase was involved in animal tissues. According to the authors' experiments, the two enzymes cannot be separated by ordinary franctionation procedures, nor can it be identified by physical and chemical treatment or by inhibitors such as cyanide and Ag . The distribution of the two activities in different enzyme preparations were the same. Finally, when D-glutamic and D-aspartic acid were added together in optimum concentrations, no additional effect was obtained. One enzyme, therefore, seems to act on both substrates in the fungus system. The new enzymatic method for the micro-estimation of D-glutamic acid is presented.

48. On the endogeneus metabolism of *Saccharomyces cerevisiae*. Hiroshi FUKUHARA and Hajime TAKAHASHI (Bull. Agr. Chem. Soc. Japan **20,** 141, 1956)

When glucose in added to yeast suspension, the yeast begins to ferment glucose immediately without a lag period, while the fermentation by yeast extracts shows a lag of time. What is the mechanism by which the living yeast can enter in the fermentation without a latent period? Does there take place a decomposition of cellular constituents to give energy to the cell? With the view of elucidating these points, we made a series of experiments.

To examine separately the metabolism of substrate and that of cellular constituents, we used C^{14}-labelled glucose prepared by photosynthesis. We used also C^{14}-labelled yeast prepared by the fermentation of C^{14}-glucose by resting cells. Nonlabelled glucose was added to the labelled yeast suspension and incubated for 15 minutes at 30°C in N_2. The total radioactivity of evolved CO_2 was about three times as great as that obtained in the absence of added glucose. From the fact that the radioactivity-time curve was linear and that the radioactivity evolved was not so great, we concluded that this phenomenon was not due to the existence of a large intemediary reservoir.

By the use of 2:4-dinitrophenol (1.5×10^{-4}M) which inhibits the incorporation of C^{14} into the cell, we observed, in the course of glucose fermentation by labelled cells, that the evolved CO_2 contained a radioactivity comparable to that obtained without dinitrophenol. We can attribute this $C^{14}O_2$ generation to a net decomposition of some cellular constituents. Now we suppose that, the addition of glucose accelerates the decomposition of cellular censtituents. This fact is observed more clearly with the cell previously treated by dinitrophenol. By a treatment for 2 hours with dinitrophenol the endogeneus fermentation practically ceases. When glucose was added to this yeast the radioactivitty of evolved gas immediately began to increase while the augmentation of the quantity of CO_2 was preceeded by a lag period.

Thus we demonstrated that when glucose is added to the yeast, the decomposition of cellular constituents first takes place, then the fermentation of the substrate begins.

This cellular constituents exist in the cold-acid soluble fraction containing trehalose, alanine, glutamic acid, and phosphate esters. These substances show a very active turnover in the corse of fermentation.

49. Fat synthesis in unicellular algae. Part 1. Culture conditions for fat accumulation in *Chlorella* cells. Hiroaki IWAMOTO, Gorô YONEKAWA and Toshinobu ASAI (Bull. Agr. Chem. Soc. Japan **19**, 240-246, 1945)

The culture conditions of *Chlorella ellipsoidea* were studied with special reference to lipide accumulation. It was ascertained that there is a close relation between the lipide accumulation and the nitrogen-deficiency in the cells. Cultivation in the nitrogen-free medium was applied in producing nitrogen-deficient cells, and cutilvating in the nitrogen-free medium, the effect of the incident light intensity, that of the initial algal density and that of the depth of the algal suspension upon lipide accumulation were investigated.

These factors greatly affect the growth in the nitrogen-free medium and the accumulation degree of lipide. In order to obtain cells of a high lipide content, it was found to be required that the initial algal density is low and the layer of the algal suspension thin. As for the light intensity, it was found that a stronger light, say 50 K lux, has a stronger retarding effect on the nitrogen-free growth in its later stage than a weaker light, say 10 K lux. This was explained to be the result of a more sever chlorosis occuring in the stronger light.

The presumptive yield of lipide by mass-culture was roughly estimated as around 4.9 ton per acre per year under such favourable conditions that each day has ten hours of illumination period of 10–50 K lux of incident light intensity and the initial algal density is 1–2 g/l in dry weight and the depth of the culture layer is about 3 cm and the culture period of each batch is about 12–24 days.

This value, if not an exact one, will present a general concept concerning the annual yield of fat in case of practical application of mass-culture of *Chlorella* for fat production in future.

Part II. Chemical composition of nitrogen-deficient *Chlorella* cells. Hiroaki IWAMOTO and Nobuhide NAGAHASHI (ibid., **19**, 247-252, 1955)

In order to learn the relation between fat accumulation and carbohydrate metabolism in nitrogen-deficient *Chlorella* cells, the changes of the fractions of carbohydrate during the progress of nitrogen-deficiency was studied in the first place. Some remarkable behaviors of certain fractions were observed. It was found that free reducing sugar increased and sucrose decreased remarkably with the progress of nitrogen-deficiency in the cells. Soluble and insoluble polysaccharides were also found to increase in the earlier stage. It is considered that fat is not synthesized at the sacrifice of carbohydrate synthesis in the early stage of fat accumulation, up to about 50%, but that, in the later stage, not only the synthesis of carbohydrate is reduced but the accumulated carbohydrate, the greater part of which is free reducing sugar, is converted into fat.

The chlorophyll content diminishes faster than the nitrogen content especially in high light intensity. Carotenoids decrease as fast as or faster than chlorophyll, and especially carotene disappears in the very early stage of nitrogen-deficiency.

50. The influence of magnesium deficiency on the growth of *Chlorella*. Yoshinori FUJIMOTO and Jyun SAKAMOTO (Bull. Agr. Chem. Soc. Japan **19**, 253-257, 1955)

Magnesium, as a controlling factor in the multiplication and the formation of cell material or chlorophyll, has been investigated at about 15 kilolux, being con-

trasted with full nutrient or in a nitrogen-free condition. In the full nutrient culture, the relative relation of these processes proceeded in a rate almost constant and the cells of about 3.5% chlorophyll content were produced in the same size at the same linear growth rate. The cell growth was continued even without taking magnesium, giving the cell size more than 3.5 times larger in volume than the normal cell and the cell digestion occured in the later stage of culture. From the sequence in which the activity of the respective processes decreasd, the level of magnesium requirement was suggested. It is probable that the formation of chlorophyll takes place at the highest level of magnesium in the cell, and the synthesis of other cell materials occurs at lower level than the cell division.

51. Studies on the growth of *Chlorella* by continuous cultivation. Part I. Yoshinori FUJIMOTO, Hiroaki IWAMOTO, Atsushi KATO and Kôichi YAMADA (Bull. Agr. Chem. Soc. Japan **20**, 13-18, 1956)

The growth characteristics of *Chlorella ellipsoidea* were studied by the continuous culture method. The exponential growth phase and the linear growth phase found in batch cultures were ascertained also in the continuous culture system. And the yields were compared with each other between the two culture systems, and were found to be the same.

The relation between the growth rate and the flow rate was postulated, and the equations which give the values of these rates and those of daily cell increase corresponding to each light intensity are presented in this paper.

Part II. Yoshinori FUJIMOTO and Teruchika ISHII (ibid., **20**, 19-24, 1956)

Equations which indicate the yield and the growth rate or flow rate at the condition that some transparent light is present, were formulated. From these equations and experimental yields, the extinction coefficient of cell suspension for compound light was calculated. It was found that if Beer's law is applicable to cell suspension, it is applicable with the changing value of the extinction coefficient through the suspension in case of compound light, from 0.42 to 0.26 for instance, because of the selective absorption of compound light by the suspension. The coefficient also changes with the change of light intensity, because the light of high intensity produces cells of low chlorophyll content, especially at a low cell concentration. And so, at a low light intensity, the yield is determined by the high value of the coefficient at a low population density and by the low value at a high population density, while, at a high light intensity, it is determined by the low value of the coefficient at both low and high population densities.

Finally, a brief discussion on mass culture of *Chlorella* is presented, with the merits and demerits of applying the continuous culture system and the multi-vessel system in continuous culture to mass culture.

52. Fundamental studies on the aerobic fermentation. Part 4. Oxygen absorption coefficient as a factor of the yeast propagation. Kôichi YAMADA, Jôji TAKAHASHI, Takuya YOSHIMURA and Toshimasa YANO (Journ. Agr. Chem. Soc. Japan **30**, 22-26, 1956)

The effect of the oxygen absorption coefficient Kd, which represents the intensity of aeration and agitation, up on the yeast (*Saccharomyces cerevisiae*, FLEISHMANN)

growth in the modified WHITE's medium was investigated, by experiments in the shaking flasks and two different types of glass jar fermentors.

The results obtained are as follows:

(1) At the exponential phase of growth, the rate of sugar consumption dS/dt is directly proportional to the rate of growth dm/dt, thus

$$\frac{dS}{dt}=K\frac{dm}{dt}$$

where the constant K, is called the "sugar consumption coefficient".

(2) As shown in Figures 1 and 2, at the value of $Kd=1.2\times10^{-6}$ the growth rate constant *r* reaches the maximum and the sugar consumption coefficient *K* becomes the minimum (that is, the yield of yeast per sugar consumed reaches the maximum), and no more increase of *r* (or decrease of *K*) is found, even if *Kd* is increased beyond this range. Therefore, aeration and agitation which are beyond some intensity have no better influence upon the yeast growth, but undoubtedly cause a loss of power.

(3) The growth rate (*r*) and the sugar consumption rate (*K*) are approximately equal under the same value of *Kd*, in any cultures in shaking flasks and in jar fermentors. This indicates that *Kd* is the important scale-up factor, when the large scale tank fermentation is to be successfully put into practice, basing on the results obtained from the shaking culture.

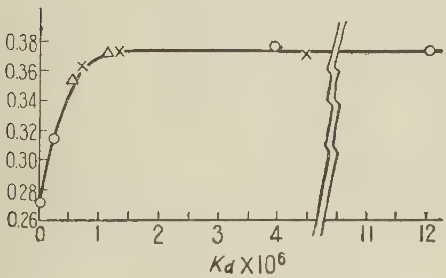


Figure 1.
The effect of *Kd* on the growth rate (*r*) of yeast
○: jar fermentor B
△: jar fermentor A
×: shake

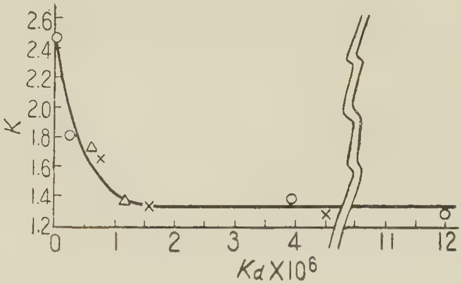


Figure 2.
The effect of *Kd* on the sugar consumption rate (*K*) of yeast
○: jar fermentor B
△: jar fermentor A
×: shake

Part 5. The influence of the oxygen absorption coefficient Kd on the gluconic acid fermentation by bacteria. Kôichi YAMADA, Toshimasa YANO, Jôji TAKAHASHI and Makio ÔKI (Journ. Agr. Chem. Soc. Japan **30**, 501-505, 1956)

Effects of the oxygen absorption coefficient *Kd* on the gluconic acid fermentation by *Pseudomenas fluorescens* 40 F were investigated. The results obtained are as follows.

(1) When *Kd* was less than about 0.6×10^{-6}, a decrease in the growth rate of bacteria was observed. A decline of the mass transfer rate at the cell surface seems to explain this fact.

(2) When a culture is growing exponentially, the amount of sugar consumed, S, and the yield of gluconic acid, P, for t hours, are considered theoretically to be given by the following equations.

$$\log S = \log K_s m_0 \frac{1}{r} + \log(e^{rt} - 1)$$

$$\log P = \log K_p m_0 \frac{1}{r} + \log(e^{rt} - 1)$$

where, K_s, K_p: constant

m_0: the bacterial density at $t=0$

r: the growth rate, defined by the equation $\frac{dm}{dt} = rm$, where m is the bacterial density at time t.

These relations were ascertained by our experiments as shown in Figures 1 and 2.

(3) Under the same value of *Kd*, approximately equal values of the growth rate of bacterial cell and the glucose ocnsumption rate were obtained, both in shaking cultures in flasks and in aerated and agitated cultures in jar fermentors. Therefore, we regard *Kd* as one of the most important factors in the submerged fermentation.

(4) During the fermentation, the yield of gluconic acid was kept between 51 and 58% to the glucose consumed, if *Kd* was high. Acid formation continued, however, after glucose had been eaten up, until the yield reached 94–95%.

This suggests that glucose is oxidized to gluconic acid by way of a certain intermediate substances.

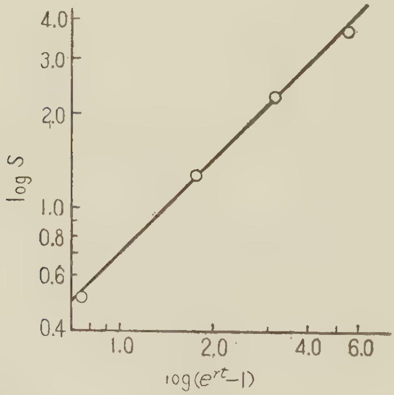


Figure 1.
Linear relation betweeu log S and log $(e^{rt}-1)$

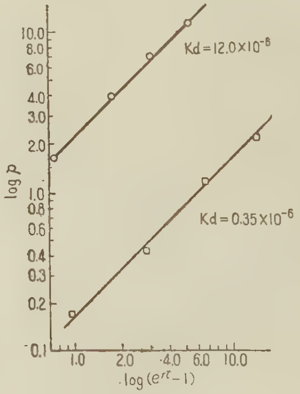


Figure 2.
Linear relation between log P and log $(e^{rt}-1)$

53. Studies on the contiouous fermentation. Part 6. Graphical solution of fermentation cycle in continuous multifermentor system. Kiyomoto UEDA (Journ. Agr. Chem. Soc. Japan **30**, 335, 1956)

The fermentation cycle in continuous multifermentor system was investigated theoretically.

(1) The fermentation cycle in two-fermentor system was prolonged especially in the latter fermentor where the mash was almost fermented out. Therefore, it was made clear that if the number of fermentors is increased, so that the first fermentor in the series operates at a higher fermentation rate, the over-all fermentation rate can be improved, namely, the total volume and the fermentation cycle of the system are diminished.

(2) In continuous multifermentor system, the following equation (2) can be given from the equation (1) of material balance at a steady state.

$$\frac{C_{i-1}F}{V}-\frac{(dC_i)}{dt}=\frac{C_iF}{V} \quad \cdots\cdots (1)$$

$$\theta=\frac{f_1C_0}{K_1}=\frac{(f_1-f_1)C_0}{K_2}=\frac{(f_3-f_2)C_0}{K_3}=\frac{(f_n-f_{n-1})C_0}{K_n} \quad \cdots\cdots (2)$$

where

C_0=sugar concentration of feed stream to first fermentation.
C_{i-1}=feed concentration to fermentor i or sugar concentration in fermentor $i-1$.
C=fermentor $i-1$.
C_i=sugar concentration in fermentor i.
F=volumetric throughput rate.
V=volume of a fermentor, all fermentors have equal volume.
θ=nominal holding time of mash in fermentor
f_n=fraction of original sugar concentration C_0 which is fermented through the fer mentor $1 \sim n$.
K_n=velocity of fermentation in fermentor n.

Therefore, a graphical solution is allowable for the fermentation cycle required to attain a conversion f with a fixed number of fermentors n, using only batchwise fermentation data to establish an empirical curve of fC. vs K.

(3) In practical continuous fermentation of molasses and sulfite waste liquor, the results obtained at the steady state were nearly equal to the values evaluated by graphical solutions.

III. Agricultural Economics

Abstract Nos. 54—55.

54. Farmers' technical role in the Meiji-period (1868-1911). Yukio SAITO (History of Development in Japanese Agriculture. **9**, 49-80, 1956)

There are many research works about the status of the rice farming in Japan.

As the figure A concerning the aspects of the development of the rice farming shows, the yield per Tan (1/4 acre) continually increased sharply for 1918-22. Compared to this, the expansion of rice farm area was not so remarkable. In other words, the yield of rice crop was more than that which corresponded to the increase

of the area. And the necessary quantity of labour per Tan decreased from 29 days in 1899 to 20 in 1939 (Table B). We can conjecture that the yield was not resulted from the increase of labour.

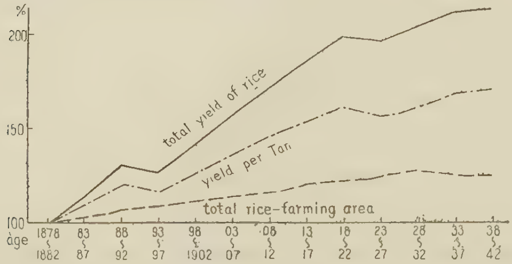


Figure A.

Table B.

age	number of necessary labour per Tan
1899	29
1912	32
1925	21.2
1934	20.6
1939	20.1

The studies conclude that in the middle of the Meiji-period rentier class took the place of the occupying owners and became the promoter of agricultural technique and the members of the agricultural experiment-station (established in 1893) which endeavoured to popularize the new knowledge which was introduced to Japan from Europe.

Consequently, new kinds of seed or manure were used without being limited by the scale of farms, but new farm implements were foregotten to be devised.

This is one of the characteristic features of Japanese agriculture.

However we must not overlook the fact that the farmers who followed the plough on their own arable land were endeavouring to devise the methods of cultivation; for example, an experimental wooden frame which was used for manuring, discovery of new kinds of rice, or making of new suitable ploughs, publication of farming books and so on.

They are the only people who have devoted all their energies to the development of the agriculture in Japan.

55. Notes on computation formulae for rice price. Isamu YANO (Journ. Rural Econ. [Nogyo Keizai Kenkyu] **27** [2], 47-56, 1955)

The government purchasing price of rice in postwar years has been decided by computation using an income parity formula, which since 1953 has been put into practice and carried out in the following way. (source: "Rice Programing in Japan", Ministry of Agriculture and Forestry Japanese Government, Oct. 1954).

I. Computation of parity rice price.

(i) First we obtain an arithmetic mean of parity index (during the period from July 1950 to June 1951) which are computed in terms of Laspyre's formula for which 1950 and 1951 are set as the basic years.

(ii) Then we devide the estimated parity index for September 1953 (represented by the index for August) by the arithmetic mean obtained in (i).

(iii) And then we multiply rice price in the basic year (an average of the secondary price in 1950 and 1951) by the quotient obtained in (ii).

$$P_I = P_B \times \frac{\sum\left(\frac{p_2}{p_0}\right)p_0q_0}{\sum p_0q_0} \cdot \frac{\sum p_0q_0}{\sum\left(\frac{p_1}{p_0}\right)p_0q_0} = P_B \cdot I_t$$

P_1: Parity rice price in the price determining year,
P_B: Basic rice price,
p_0: Prices paid by farmers in base year,
q_0: Quantity purchased by farmers in basic year,
p_1: Average prices paid by farmers from July 1950 to June 1952,
p_2: Prices paid by farmers during the month in which rice price is fixed,
I_t: Parity index,

2. Computation of special additional payment.

(i) Correction coefficient to living cost in the parity formula in order to maintain the balance of consumption levels between urban and rural districts.

Such correction is to lessen a gap between the rising rate of the physical consumption level in urban district to that in the basic year and the rising rate of the physical consumption level in rural district to that in the basic year. A gap between the two rising rates represented by α' is computed as follows;

$$\alpha = \frac{\sum^{u} p_tq_t}{\sum^{u} p_tq_0} \Bigg/ \frac{\sum^{r} p_tq_t}{\sum^{r} p_tq_0}$$

p_t: Prices of home supplies in the price determining year,
q_t: Quantity of home supplies in the price determining year,
q_0: Quantity of home supplies purchased during the basic year,
u: urban, r: rural district,

(ii) Correction coefficient to the farming expenses in the parity formula in order to take into account the changes in purchased capital goods that were invested per unit acreage.

Changes in the investment in capital goods are indicated as follows:

$$\alpha = \frac{\sum p_t'q_t'}{\sum p_t'q_0'}$$

p_t': Prices of capital goods invested for the rice price determining year,
q_t': Quantity of capital goods invested for the same year,
q_0': Quantity of capital goods invested for the basic year,

(iii) Computation formula for special additional payment.

$$P_C = P_B \times \left\{\frac{\sum p_2q_0}{\sum p_0q_0} \cdot \alpha\,(1-w) + \frac{\sum p_2q_0}{\sum p_0q_0} \cdot \alpha' w\right\} - P_I,$$
$$= P_B \cdot \beta_t - P_I,$$

P_C: Special additional payment,
w: Weight in the family living expenses,
1-w: Weight in the farming expenses,
β_t: Index representing simply the sum of both correction coefficients multiplied by each weight,

3. Computation of the final price is carried out as follows;

$$P_f = P_I + P_C + S = P_B \cdot \beta_t + S$$

P_f: Final prices in the price determining year,
S: Incentive payment to farmers,

Notes

The parity formula is originally considered as a comparative static method. One of the purposes of this paper is to stand for the dynamic model building, which has the concept of the static, by means of introducing some difference equations.

1. On the price in the base year:

If the arithmetic mean of prices in 1950 and 1951, both of which are set as basic years, stood for the moving average price in two and three before the price deciding year, the base year's price comes to be described as follows:

$$y_t = \tfrac{1}{2}(y_{t-2} + y_{t-3}) \cdot I_t,$$

y_t: Price of the present year,
y_{t-2}, y_{t-3} are 2 and 3 years before,
The solution of this equation would be, $y_t = A\sin\theta t + B\cos\theta t + C$, ($A$, B, C: const.), here assuming that I_t is equivalent to 1.

Such a method has been adopted not only in the farm products price policy of U.S.A., but also in "A Reconsideration of the International Wheat Agreement, 1952, FAO". Since the writer considers that the price of this year depends mostly upon the economic conditions which prevailed in the previous years, he introduces the moving basic year for trial. Even in the case of great changes of the national economy or in the fluctuating price level, he may expect to have a fairly stable price system and therefore a stable economy autonomously, if introduced such a model.

2. On the price of the comparative year:

The price of the comparative year is defined as $P_B \cdot \beta_t = P_C + P_I$. For the simplification it is set as, $y_t/y_0 = a(1-w)\alpha + bw\alpha' = \beta_t$, ($y_0$: Index of the basic year, conviniently introduced.) Here the writer adopts a crude assumption as follows, $y_t = Ay_{t-1} + B$, (A, B,: const.) It means that the price of this year changes in the constant proportion (linearly) to that of the last year. Under this assumption, he gets a solution, $y_t = (y_0 - 1) + B\left(\frac{1-A^t}{1-A}\right)$, When $A > I$, y_t will diverge, and $A < I$, y_t will converge.

Now, he would like to observe the computation formula from other stand point. It may be generally approved that the cost and the wage for rice farming in this period depend, first of all, on the price of the previous year. Accordingly he shall introduce price elasticities of the cost and the wage, and describe them as $\eta_c = \frac{\Delta C}{C} \Big/ \frac{\Delta Y}{Y}$, $\eta_k = \frac{\Delta K}{K} \Big/ \frac{\Delta Y}{Y}$, ($C$:Cost, K:Wage, Y:Prices). He now assumes them as constant, and gets approximately the following relations, $y_{t-1} = \Delta Y/Y + 1$, $c_t = \Delta C/C + 1$, $k_t = \Delta K/K + 1$, and $c_t \fallingdotseq (1-\eta_c) + \eta_c y_{t-1}$, $k_t = (1+\eta_k) + \eta_k y_{t-1}$, ($c_t$, k_t represent index of the present year, and t-1 the previous one) Consiquently, he obtained, $Ay_{t-1} + B \fallingdotseq (1-w)\,c_t + wk_t = [(1-w)\ \eta_c + w\eta_k]^{t-1}(y_0 - 1) + 1$, and thus, $y_t/y_0 \fallingdotseq \beta_t = a\,(1-w)\ \alpha + bw\alpha' \fallingdotseq [(1-w)\,\eta_c + w\eta_k]^{t-1}$.

The writer tried to combine the concept of the elasticity to the computation formula by introducing a difference equation.

3. On the final price:

The final price includes incentive payment to farmers in addition to the parity price. It would be described as follows, $P_f = P_B \cdot \beta_t + S$, or with a suffix representing time as, $y_t = Ay_{t-1} + B + as_t$, ($a$: const. s_t: Index of the incentive payment of the present year). The

solution comes out as, $y_t = as^{t+1}\left[1-\left(\frac{A}{s}\right)^{t+1}\right] \Big/ (s-A)$,

In conclusion A and S must be decided reversely each other so that the possible divergence as well as convergence of y_t may not take place. And then the rice price should be determined so as to secure the farmers' income from rice farming on the one hand, and on the other hand to be sensitive to the general price level. Because rice is one of the so-called representative wage goods in Japan, and has a heavy repercussion effect in every section of our national economy.

IV. Agricultural Engineering

Abstract Nos. 56—68

56. Diffusion of water vapor and its exchange between condensation and evaporation in soil. Hitoshi FUKUDA (Soil Science **81** [2], 81-95, 1956)

57. Underdrainage into ditches in soil overlying an impervious substratum (Exp.) Hitoshi FUKUDA, Yasuo GOTO, Saburo SASANABE (Journ. Arg. Eng. Soc. Japan **24** [1], 38-40, 1956)

In this paper are tested experimentally several of the theoretical equations derived by FUKUDA for the quantity of water, in water-saturated soil, seeping per unit time, from a plane table into equally spaced ditches with vertical walls.

It was found that max. discharge into ditches is calculated by permeability coefficient of soil, that this max. discharge in cases of (1) their being directly on, and (2) being at the distance two times of their own depth above an impervious substratum are about three fourth, and nine tenth respectively of that in case of the impervious substratum being infinitely deep.

58. Statistical analysis of damaged reservoirs for irrigation use. Shozo NOGUCHI and Yoshiharu IWASAKI (Collection of Lectures given at Lecture Meetings of Agricultural Engineering Society, Japan 1956)

As of 1952 the number of reservoirs irrigating over 5 ha. reached about 50,000 in Japan out of which about 18,000 reservoirs were damaged by some reason or other, and require repairing or improvement works. Out of those reservoirs, damaged by various causes, the authors picked out 1,483 reservoirs in 10 prefectures comprising of 6 prefectures of the north-eastern provinces and 4 prefectures of the Shikoku province which had spillways insufficient in dimension and required improvement, and analyzed as follows:

D (ha): river basin of a reesrvoir.
A (ha): maximum water surface.
L (m) : width of overflow spillway.

Designating $L/D=\alpha$, and $A/D=\beta$, they made research about the numerical values of α and β.

The smaller the value of α, or the width of a spillway per unit area of a river basin, the lower the drainage capacity of a spillway becomes. This means that damages due to insufficient dimension of spillways are liable to occur.

And the smaller the value of β, or the water surface of a reservoir per unit area of a river basin, the higher the rise of the water level of a reservoir by rainfall.

Plot α value on the abscissa and β value on the ordinate of the rectangular coordinates. Then the reservoirs plotted near the abscissa and the ordinate are liable to suffer from damages due to the overflow of spillways.

From 1,483 reservoirs as mentioned above they selected 311 reservoirs belonging to the category in which river basins are larger than 30 ha. and A/D <0.05, and investigated the distribution of their α values.

The result was as follows:

Distribution of α values.

α values	0.–0.1	0.1–0.2	0.2–0.3	0.3–0.4	over 0.4	total
Number of Reservoirs	278	16	6	4	7	311
Percentage (%)	89.4	5.1	2.0	1.3	2.2	100.0

α-values of the greater part of reservoirs are smaller than 0.1, and the reservoirs having their α values over 0.3 are only 3.5%.

The reservoirs in question were investigated by the prefectures concerned, but the prefectures concerned didn't always adopt a fixed survey standard in case of the survey of reservoirs. The analytical method, however, was practised on the basis of their own characters. The larger part of the reserovirs (about 80%) were constructed about 80 years ago, and it is desirable from the above analytical investigations to decide α values at least over 0.3 in order to prevent the damages due to insufficient dimensions.

59. On agricultural water utilization. Kagato SHINZAWA (Tokyo University Publishing Association, Tokyo 1955)

Introduction.

Various contradictions concerning the agricultural water utilization (illogiciality in traditional water utilization), which are found in such items as quantity of water intaken, charges for cost and labor, administrating organization, rent of water, etc. come from the regional disaccord of interests which has a close connection with the character of the Japanese agriculture in which the flowing water is used as means of production. From the historical point of view, the interests between farmers in one region and others in another region didn't agree with the feudal system of the Tokugawa era regarding the water utilization, and moreover, in case the dominating power of a region or regions are divided into different feudal lords, the contradictions are the problems to be caused by the conflict of interests among feudal lords. Since the Meiji Restoration, the private ownership of land has been established, the contradictions have occurred from the disaccord between landowners and farmers on one hand, and other landowners and farmers on the other. After the agricultural land reform, the farming people generally become the owners of their cultivated fields, and the antagonism of interests developed into those among the farming people in that region.

In our agriculture, historically, the irrigation and drainage are treated as factors of paddy fields. Land and water are not treated separately from relation of the

rice paid as land-tax or rents for tenancy, etc. produced from the ownership of land and water. In the areas which are being irrigated by irrigation resrevoirs and always suffering from shortage of water, the land ownership and water diverting right to paddies are distinguished. And in some of them sale and loan of water diverting right to paddies only were practised separately from the ownership of land, but these are only exceptional examples. The various contradictions concerning the agricultural water utilization as mentioned above may not be regardless of the fundamental production relation, but it is better to consider it separately in this case.

Most of the investigators of agricultural problems, however, have made such a conclusion that the various contradictions which occur in the agricultural water utilization are only the relic of the feudal days, and insist that they are surviving forms of such fundamental production relations, as antagonism between feudal lords and farming people, and that between landowners and farming populace. Quite contrary to many advocates of the above-mentioned opinion, the author insists that the contradictions concerning the agricultural water utilization come from he regional antagonism.

Chapter 1. Unification of intakes of irrigation water.

The author investigated how the various conditions concerning intakes of irrigation water undergo complete changes by the unification of the intakes, by taking the cases of three rivers of Toyama Prefecture,—the Shokawa River, the Joganji River and the Kurobe River, and proved that his insistence is quite right, comparing historically the changes of production relation and studying the various conditions from topographical and engineering point of view.

Chapter 2. Construction of irrigation and drainage channels.

Construction of irrigation and drainage channels is the process of realization of contradictions in the agricultural water utilization. The author historically investigated the construction of irrigation channels and management of the Minumadai Irrigation Project, Saitama Prefecture; construction of the channel of Edzure Irrigation Project, Ibaraki Prefecture; and process of formation of irrigation and drainage channels of the lower Kiso River, and treated the same thesis as above, proving that his insistence is quite right.

60. Research on expansion of uses of power tiller. Part 2. Fusanobu SHOJI and others (Rept. Sci. Res. of Education Ministry, 1-59, Aug. 1955, printed by institute of Agr. Machine.)

The authors clarified the adaptability of a power tiller by carrying out an experiment to see whether or not the tiller may be used in other fields of operations than tillage. They conducted actual experiments relating to such capacities as travelling power, tractive power, cultivation, soil removing power, which they had confirmed in their first report, and could get information about the adaptability of the special characters in various farming operations by applying simple attachments to a tiller.

For the utilization of the travelling power, they made such experiments about the tractive power for a sledge, snow removing work by attaching a snow-removing board and snow consolidating operation by attaching a pressure board in snowy districts. And at the same time they also practised climibing and descending operations by a tiller on a sloping land. As for the tractive power of a tiller, they practised the following operations: stump-pulling operation for such stumps as about 5–6 cm in

diam., digging operation of sweet potatoes by attaching a digging device, treading operation of barley or wheat by means of a roller and spraying operation of agricultural chemicals by a power sprayer carried on a rear-car drawn by a tiller. As for the application of cultivation capacity they made experiments on such items as plowing and burying Chinese milk vetch into the soil, removal of stubbles of upland rice-plants, digging-up potatoes, etc. For the soil moving capacity they made experiments about earthing up the roots of barley or wheat and high ridge preparation operation. The above experiments for the increase of the range of uses of power tillers were not always successful, but a fair prospect for the adaptability for various uses has been given by the above experiments.

61. On the revolution ratio of two rubber-rolls of the huller and its hulling fanction for paddy. Fusabobu SHOJI (Journ. Agr. Machin. Soc. Japan **18**, 33-36, 1956)

The author made an investigation on the reuqired power, hulling rate, damage degree of grain surface, etc. in case a grain was supplied one by one into the clearance between two rubber-rolls. In this case the chief subject of his investigation was to change revolution ratio of the two rubber-rolls. Thus he could clarify the following items:

1. In case the revolution ratio is the same, the smaller the clearance between two rubber-rolls, the larger becomes the required power for hulling; and in case the revolution ratio becomes larger than the boundaries which ranges from 23.5 to 29.4%, the required power for hulling suddenly increases in general.

2. Hulling condition for paddy by means of two rubber-rolls is clearly influenced by the direction of the grain supply. Hulling is easy in case the grain is supplied into the clearance in the longitudinal direction, and of course the contrary is in case of the transverse direction.

3. Hulling rate is also influenced by the size of the clearance between two rubber rolls, but in case the revolution ratio becomes larger than the boundaries of 23.5% and 29.4%, a tendency of sudden increase of the hulling ratio is seen, and at the same time the damage degree of grain surface of hulled rice will also increase.

The results obtained as mentioned above will lead us to such a conclusion that as a desirable hulling function, the required revolution ratio of two rubber-rolls is about 23.5%, which is the maximum revolution ratio within the sphere where such function is operated, even if the hulling rate more or less decreases, on the assumption that the power required and the damage on the grain surface are as little as possible.

62. On quality improvement of common salt by adding Manganese Salts. Jiro SUGI and others (Bull. of Salt Sci. Japan **10** [1], 1956)

The authors practised their experiments in the laboratory, relating to particle radii, crystal form, transparency and improvement of component on the part of the produced salt by adding salts of Mn^{2+} and surface-active regents of various concentrations for the purpose of quality improvement. After that they achieved expected results by practising a field experiment.

In the laboratory they used $MnSO_4$ and B.A.F. (foam-breaking reagent in the hexitan ester system) as surface-active regent, and in this case additions having 5 kinds of percentages were used as follows:

(a) Mn^{2+}1100 p.p.m., B.A.F. 10 p.p.m.
(b) Mn^{2+}10 p.p.m., B.A.F. 10 p.p.m.
(c) Mn^{2+}5 p.p.m., B.A.F. 10 p.p.m.
(d) B.A.F. 10 p.p.m.
(e) Mn^{2+}100 p.p.m.

An they compared the results obtained in the above with cases of no additions, as a result of which the results were in the order of (a) > (b) > (c) for the all experimental items of crystal form, transparency and component, and in case of (d) and (e) they were only little better as compared with cases with no additions. In case Mn^{2+} salts were added the brown $Mn(OH)_2$ was produced in the solution above PH 8, and the color of the produced salt was worsened.

The content of Mn^{2+} in the common salt is about 5 mg-Mn^{2+}/(100 g of common salt) in case of adding Mn^{2+} 100 p.p.m.

They added Mn^{2+} 20 p.p.m., and B.A.F. 10 p.p.m. and practised the following field experiments;

Once in a thermo-compression evaporation system.

4 times in a vacuum-evaporation system.

4 times in a closed-pan system.

As the result of the experiment betterment of salt quality was recognized in the thermo-compression-evaporation and vacuum-evaporation systems in the same way as in the case of the laboratory, (Refer to Table 1); but in case of the closed-pan system no effect was observed.

Table 1.

Factory	Addition of Mn^{2+}	Composition %							
		Water Content	$CaSO_4$	$MgSO_4$	$MgCl_2$	Na_2SO_4	KCl	NaCl	Total
Thermo-compression Evaporation system	None	0.09	0.26	0.08	—	0.59	—	99.29	100.31
	Added	0.05	0.19	0.05	—	0.31	—	99.63	100.23
Vacuum Evaporation system	None	4.41	1.76	2.99	—	0.71	0.10	89.72	99.69
	Added	3.33	0.50	0.85	0.48	—	0.09	95.40	100.65

63. Scale prevention by method "addition of crystal seeds". (II). Jiro SUGI and others (Bull. of Salt Sci. Japan **10** [1], 39-45, 1956)

The authors practised the folowing experiment on the basis of the fundamental researches which had been published in the first report. (Bulletin of the Society of Salt-Science, Japan. 9, 1, 39–45.).

The two thermocompression-evaporation systems having heating areas of 3.3 m^2 (Odawara Salt Manufacturing Exp. Stat. of Japan Monopoly Co.) and 500 m^2 (Onahama Factory of Japan Monopoly Co.) were used.

At first an amount of the anhydrous $CaSO_4$ in order that may become 0.3 cc/10 cc, when deposited by means of the centrifugal force, was mixed into the liquid in the tube. An the liquid was concentrated for 100–250 hours under such conditions that

its temperature and the velocity of flow in the heating pipe were 105–113°C and 2 m/sec. respectively. But the drop of the overall coefficient of heat-transfer wasn't resulted. After the experiment they could not recognize any scale formation in the heating pipe with the naked eye.

According to the accurate analysis the rate of scale formation was 0.006–0.009 Kg $CaSO_4$/KL evaporation, the result of which coincided very well with the fundamental result in the preceeding report, which is considered to be a very excellent result.

The crystal seeds used in this case was anhydrous $CaSO_4$ which was deposited by the process of crystalization at Onahama Factory and the particle size was about 12 (measured by means of sedimentation), but the size grew up as large as about 22 by the repeated use for 100 hours. The dissolved content of $CaSO_4$ of the liquid in the tube neared the solubility of the anhydrous salt in several hours, and the addition was quite effective.

From the above result it has been clarified that the above method may be applied to the concentrating process of brine in the parts of the comparatively high temperature in the thermocompression evaporation and vacuum evaporation systems.

64. On movement of flow in evaporation pipe. (I) Losses of pressure in heating pipe and downtake tube—Jiro Sugi and others (Scientific Reports of Central Research Institute, Japan Monopoly Corporation, No. 93, 103, 1956)

At present the most important salt manufacturing equipment which is generally adopted in salt manufactories is the vacuum evaporation system, and the evaporation tube is the so-called standard type which is nearly alike in shape in any factory. But as many traditional factors are involved in the designd of the system, and moreover, the process and environment have made much progress of late, it may not be said the evaporation tube at present is the best. In order to get real information about the actual state, and to find out the future direction, the authors practised a model test concerning the pressure drop of the liquid in the tube.

(1) Pressure Drop in Heating tubes.

The parallel tubes which form the group of heating ones are the most general heat exchanger, which is also used as the preheater or the surface condenser. As the result of the experiment it was clarified that the coefficient of the pressure drop at the entrance and outlet of the parallel tubes is expressed by the function of the sectional area ratio, the value of which is nearly equal to the value of a single tube. The total coefficient of the head loss is about 1.5 for the dimension of the present heating tube.

(2) Pressure Drop at Inlet of Downtake Tube.

The coefficient of the pressure drop at the inlet of the downtake tube is the funtion of H/D (where H: water depth at the inlet of the downtake tube, D: diam. of the downtake tube.) and Reynolds number, and also influenced by the turbulence of the surface shape of the liquid. The investigation on the present standard evaporation tube on the basis of the above result gives the following conclusion:

The greater part of the flowing resistance is brought about in the downtake tube, and in order to minimize the resistance it is necessary to enlarge the liquid depth and H/D, and to reduce the resistance by forming a bell-mouth at the entrance and outlet.

Moreover, it was made clear that the larger part of the circulating electric power will be saved, which accounts for about 1/3 the electric energy used at the factories, by lengthening the heating tubes in order to reduce the quantity of circulating liquid for the required heating area and the velocity flow in the heating tube.

65. On the manufacture of potassium sulphate from sulphate of soda and potassium chloride. Jiro SUGI and others (Scientific Papers of Central Research Institute, Japan Monopoly Co. No. 93, 111-125, 1956)

As the potassium sulphate is required for fertilizer use, potassium sulphate and common salt are being manufactured by means of double decomposition from imported potassium chloride and sulphate of soda which is manufactured as a by-product in the artificial silk-manufactories.

In case potassium sulphate is directly manufactured, its production is only little from the relation of solution equilibrium, and the mother-liquid required much. Such being the case, the manufacturing process is divided into the following categories and put into practice:

1) The saturated solution of potassium chloride and sulphate of soda are mixed at their boiling points, and concentrated. After depositing glaserite (Na_2SO_4 K_2SO_4) by cooling it as low as 25°C, the mother-liquid (a) is separated.

2) The saturated solutions of glaserite and potassium chloride are mixed at their boiling points and concentrated. After depositing potassium sulphate by cooling it as low as 25°C, the mother-liquid (b) is separated.

3) After depositing common salt by concentrating the mother-liquid (a) at the boiling point, the mother-liquid (c) is separated. If the saturated solution of sulphate of soda is added to the mother-liquid (c) at the boiling point, and concentrated, glaserite will be deposited by being cooled as low as 25°C, and the mother-liquid (d) is separated.

The mother-liquid (d) is considered to be of the same composition with the liquid (a), and glaserite will be deposited from the mother-liqued (b) by the same process with the mother-liquid (c), and separated from the mother-liquid (e). Thus the mother-liquid (e) and (a) will be of the same composition. By repeating the above mentioned process potassium sulphate and common salt may theoretically be manufactured without causing a loss.

In the experiment the sodium sulphate in artificial silk industry of 1) was used after neutralization of free acid by Na_2CO_3 and removal of Zn^{2+} were practised. For 2) and 3) the special reagent was manufactured on the basis of calculation and used for the purpose without using the products made through the above manufacturing process in order to facilitate the comparison with the calculated value. The above result showed that the calculation for the solution equilibrium on starting from the state of solution coincided very well with the result of the experiment in a beaker.

66. Preliminary report on intake rates decrease of paddy field in relation to structural changes of its surface soil. Toshio YAWATA (Journ. Agr. Eng. Soc. Japan **23**, 269-272)

In case paddy fields have newly been created in a reclaimed area on a table land, it is common sense that much irrigation water will be required as compared

with that of the matured paddy fields, for the percolation of water is very heavy in the early period of reclamation.

But with the lapse of time, after the paddy area was created, the intake rates of irrigation water gradually reduces. The reason why this phenomenon takes place, corresponding to what kind of structural changes brought about in the interior of the soil, has not been fully investigated yet.

Since 1954 the author has commenced his study about this theme in an experimental field established in the Mikatagahara settlement, in Shizuoka Prefecture.

Since the paddy area was created, he has continued to collect periodically soil from 3 kinds of depths. And by certain methods he is investigating such physical properties of soil as silt %, clay %, degree of aggregation, void ratio, Darcy's coefficient of permeability, amount of roots per 100 cc, which are considered to exert influences upon the percolation of water.

The above survey is being continued at present, and will be continued until the intake rates of irrigation water in the paddy field become similar to that of the matured one. Accordingly in this paper the preparations until the survey began and the methods of survey have only been described as a preliminary report.

The numerical changes that the above mentioned items undergo with the lapse of time will be published in the future reports.

67. Weiterentwicklung der Lenkungen selbstfahrender und gezogener Fahrzeuge. Yoshichiro YASUDA. (Introduced by K. Hain in the Landtechniksche Forschung, 1956, Heft 3, 93/95, for the dissation "Zur Kinematik der Lenkgetriebe, insbesondere für selbstfahrende und gezogene Landmaschinen.")

68. Comparative study on soil-binding power by roots. Fujio YAMAZAKI, Toshio YAWATA, Koichi SOMA, Noboru NAGATA (Data and Records for Investigation No. 1)

If embankments and flood basins of rivers could be used for the production of superior pasturage, it must be a godsend for livestock industry in Japan. But sodding has been considered to be a unique measure for the protection of embankments up to now, and it has been said that the roots of pasturage will loosen the soil and be dangerous from the standpoints of prevention of damage by floods, in case pasturage is introduced instead of sod. Therefore, in order to get information about whether or not the roots of pastuarge will really loosen the soil, the authors conducted a comparative experiment concerning the soil-binding powers. For the experiment we select the flood basin of the Fuyefuki-River in the suburbs of Kofu city and that of the Nagara-River in the suburbs of Gifu city as the experimental sites. In a sod and a pasturage plot where clover and orchard grass, etc. were planted, we conducted a comparative experiment on such items as the distribution of roots, resistance of the soil to penetration, and the resistances against the erosion due to washing of water and scouring erosion.

The above experimental results are summarized as follows:

(1) At the depth of 10 cm from the ground surface the clover-orchard has a stronger soil binding power as compared with field sod (*noshiba*) or grass sod (*Shibakusa*). Accordingly, it is considered that the pasturage has a stronger resistance against scouring erosion after the surface of embankments or after flood

basins has been washed away.

(2) The resisting power of the grass against surface scouring due to flowing water is not considered to be inferior to that of field-sod or grass-sod.

However, the conclusion should not be made without the following reservations.

(1) The above experimental plot was prepared in a flood basin of sandy soil (sand or sandy-loam), and the above conclusion may not be applied to all sorts of soil.

(2) In case a pasturage is of a stubble forming variety, weak spots against protective power which are easily subject to erosion or scouring are made among the stubbles. The above are the problems which should be investigated more closely.

V. Fisheries

Abstract Nos. 69—110

69. Some notes on the radioassay of contaminated Fishes. Ryushi ICHIKAWA and Yoshio HIYAMA (Research on the Effects and Influences of Nuclear Bomb Test Explosions, Jap. Soc. Prom. Sci., 883-888, 1956)

In order to examine the radiologically contaminated fishes caught in the Pacific Ocean, the authors carried out some experiment concerning the method of radioassay of these materials.

(1) Self-absorption of the sample in various cases. The radioactivity of the selected tissue materials from *Tetrapturus angustirostris* were assayed under three conditions (wet, dry, ash), in various amounts and were compared with each other. Though wet tissue is not adequate as a sample for radioassay, the authors had to measure it in this condition for immediate survey and for comparison of the activity. As small bones of fish found in the stomach contents have a thread-like form, self-absorption is not remarkable even in the wet condition. On the contrary, in case of the juice in stomach content, it is remarkably large. But, these two samples are the extreme cases and the ordinary samples of body tissues represented by the sample of pyrolic caeca were examined and showed a fair amount of self-absorption. If the moisture is taken out by drying, the self-absorption becomes much less than the wet tissue, but the absolute activity cannot be calculated by this method. And for this purpose the ashed sample was needed.

(2) The relationship between the radioactivity of body surface measured by survey meter and that of muscle 1 gram. The Ministry of Health and Welfare made radioactivity examinations at tuna landing ports in Japan, and at that time they temporarily adopted, 100 cpm (including natural count) as a standard to recognize the fish contaminated by artificial radioactivity. This was measured by the common mica-window type G. M. counter at a distance of 10 cm away from the surface of the fish body. Therefore, we needed some conversion factors to convert the net count of radioactivity in fish muscle in the condition of least self-absorption to the count of radiation coming out from the body-surface of fish measured by survey meter.

Examining the data obtained from many examples of contaminated tuna, it was concluded that if the muscle of tuna has a radioactivity of 10 cpm/g, that of the fish may be assayed from the body surface (10 cm apart) 100–1,000 cpm.

70. State and behavior of fission products in fresh-water, brackish-water and marine coastal systems in Japan, 1954-'55. Yoshio HIYAMA, Ryushi ICHIKAWA, Toshio ISOGAI, Yasuo OSHIMA, Haruyuki KOYAMA, Seibin ARASAKI and Koji NOZAWA (Research on the Effects and Influences of the Nuclear Bomb Test Explosions, Jap. Soc. Prom. Sci., 1027-1065, 1956)

The fission products, recognized in the Pacific Ocean, at the head of Kuroshio current which comes up north along the Japanese coast, and also in rain water which had fallen in various parts of Japan, was supposed to add some radioactivity to the water systems in marine coastal, and fresh-water areas. We surveyed the marine coast, brackish water, river, natural and artificial ponds of various sizes and types since spring of 1954 and after elaborative radioassay, we have come to the following conclusions.

(1) Rainfall and fall-out dust were recognized to have fission products here since spring of 1954. Before the radioactive materials go into the natural stream by rain water, their activity is decreased to a great extent, as a result of absorption by soil, living organisms, and as well as various kinds of plants growing on these surfaces. Hence the activity of the river-water becomes considerably faint.

(2) It is nearly the same in the case of natural ponds and lakes, though they were shallow enough, and had rainfall or fall-out dust directly to the water in it. These radioactive materials in pond waters are easily caught by micro-organisms, algae, detritus and soil at the bottom and edge.

(3) However, in the case of small concrete pond, porcelain pot or other vessels, without having enough amount of bottom soil, micro-organisms or plants, the water in it cannot dispense enough fission products to these materials, and often considerable activity was found in it, until it decays physically as time passed on.

(4) As river water, poured into the brackish bay has almost no activity at the time we surveyed, the brackish water surveyed showed no remarkable activity at all. Though the area would get the supply of sea water from the Pacific, the sea water from the mouth of bay had little or no activity by itself, and no influence could be added to the bay water by this.

(5) As far as the marine organisms in coastal regions are concerned, during our survey of over one year, we did not find any considerable radioactivity except faint detections in several fish kinds, and in some invertebrates.

71. Movement of fishing grounds where contaminated tunas were caught. Yoshio HIYAMA and Ryushi ICHIKAWA (Research on the Effects and Influences of the Nuclear Bomb Test Explosions, Jap. Soc. Prom. Sci., 1079-1084, 1956)

Since the middle of March, 1954, the Ministry of Health and Welfare of the Japanese Government examined radiologically fishes brought back by tuna longline boat at the landing fish markets, and the fish having radioactivity over 100 cpm by G-M counter at a distance 10 cm from the surface was regarded to be contaminated by fission products. Therefore, the authors wanted to see the seasonal change of the

fishing grounds where the contaminated fishes were caught, plotting these on the map with regard to the month when they fished. The results obtained are as follows.

(1) Yellowfin tuna. *Neothunnus macropterus* (Kiwada). During the spring months the occurrence of the contaminated fish was limited in the area around the Marshall Islands, more to the east of Bikini Atoll than to the west of it (area A). In May, such area moved to the west, i.e. to the East Caroline Islands (area B) and went to the north up to the area between the east of Formosa and the Bonin Islands (area C) along the route of Kuroshio current where some were found already in late April. In June, the most of these fishing grounds are in the area C. And in July and August, mostly in Micronesia, more in Carolines than Marshalls. In September and also in October, the fishing grounds were scattered around mostly in Micronesia. During winter, these grounds are rather concentrated into two groups, the one at area C and the other in area B.

(2) Albacore. *Germo germo* (Bincho). During the spring months, it was limited within the area A and in summer months it moved to the area B and then in fall and winter went up to the area C, fairly along the route of Kuroshio Current. Some spots in fall and winter were found back to the south, i.e. several in Carolines and one in Marshalls.

(3) Big-eyed tuna, *Parathunnus sibi* (Mebachi). This species shows some similarity to yellowfin tuna and at the same time some to albacore in the type of movement of these spots.

(4) Skip-jack, *Katsuonus vagans* (Katsuo). The contaminated fish were found only in spring and fall, but not in summer, when the most of this fish is caught by pole and line, a busy fishing season in the area much near to the coast of Japan. This is supposed to be due to the system of examination, as no pole-and-line fishing boats were recorded here.

(5) One of the Japanese spearfish, *Tetrapturus angustirostris* (Furaikajiki) The movement of the contaminated area of this fish concerned, is quite similar to that of yellowfin tuna. However, the movement is about one month later than that of yellowfin tuna.

(6) Sail fish, *Istiophorus orientalis* (Bashokajiki). This species shows the type of movement quite similar to that of yellowfin tuna.

(7) Black marlin, *Makaira mazara* (Kurokajiki). This species also shows the type of movement quite similar to yellowfin tuna.

(8) Striped marlin, *Makaira mitsukurii* (Makajiki). The spots where this species was found is rather concentrated in the area C, mostly May and June, and a few in the south.

(9) Sword-fish *Xiphias gladius* (Mekajiki). The data is so few about this species that nothing can be considered.

(10) Spanish mackerel *Sawara niphonia* (Sawara). This species shows the similarity to the striped marlin.

(11) *Scomberomorus chinensis* (Okizawara). This species has slight difference as regards the movement of the contaminated area in the point that this species shown up in the area B especially in July, August and September, and a few in later months in any other parts.

(12) Dolphin *Coryphaena hippurus* (Shiira). This species is a sort of by-

product, a few spots in area A and B and mostly concentrated in area C especially in April, May and June.

72. Studies on the processes of contamination of fish by the fission product. Yoshio HIYAMA, Ryushi ICHIKAWA and Fujio YASUDA (The Research on the Effects and Influences of the Nuclear Bomb Test Explosions, Jap. Soc. Prom. Sci., 1119-1113, 1956)

Various fishes contaminated by fission products caused by hydrogen-bomb test carried out at Bikini Atoll have been caught from the Pacific Ocean from March 1954. So we had to study the processes and mechanisms of contamination of fish by fission products by hydrogen-bomb explosion, in the laboratory and the aquarium, using the radioactive dust obtained from the Japanese tuna fishing boat, Fukuryu-maru No. 5, on which the fission products had fallen. Our experiments were carried out by the methods of rearing in contaminated water and by oral administration. The following results were obtained as a result of these studies. In the contaminated water by fission products, the radioactivity of which was 100 cpm/1 and 1,000 cpm/1, fishes scarcely obtained radioactivity. And sea fishes scarcely obtained the radioactivity from the contaminated water of 10,000 cpm/1. On the contrary, fresh-water fishes could surely obtain the radioactivity from the water of this concentration. From these results, it is sure that freshwater fishes absorbes fission products from the water easier than sea fishes. Variation of the rate of absorption of fission products was found to be very great in both cases.

The mortality rate of fishes in this contaminated water was found to be fairly high. Studying the relationship of radioactivity of fishes to their body lengths, now it can be only said that the physiological and physical absorption of the fission products would take place to a fair extent, but the mucus of fish body had the nature of adsorbing the fission products from the water. As the materials used in the oral administration were unusual ones for the living fishes, absorption of the fission products from the contaminated materials inserted into the stomach of fish was very slight, and put out almost unabsorbed, especially in the case the fission products which were given in the inorganic form. However, when the food had been contaminated, the activity taken up by fish was found to be considerably high. These series of experiments in our laboratory and aquarium may give us some key to peep into the natural process of contamination of fish by fission products caused by the hydrogen-bomb explosion in our near ocean.

There are apparently two processes of contamination by fission products: one is the direct up-take of fission products through the body surface, such as skin, gill and oral cavity from sea water, and the other is the indirect, through the food channel.

The first process would take place when the sea water has high activity, at first adsorbed by the mucus layer in the body surface physically, and then penetrated into the tissues of body physiologically.

The second may happen as long as the fish can take the contaminated food organisms, even though the fish live in water having only little fission materials which is less than the level that would cause the first process. The fall-out itself might not be taken by fish through the mouth in nature, (though the water may contact its inner epithelium), as in the expeirments we have done, but if it happens, then the absorption of these through alimentary tract may be very slight and most of these

are put out through that canal unabsorbed. However, if the fission products are taken up by food organisms at first and then taken up as food by larger fishes, they would absorb it more easily, and this can be supposed to happen usually in the open sea.

73. Deposition of radiostrontium in the various tissues of Jack mackerel, mackeral and tuna. Ryushi ICHIKAWA and Yoshio HIYAMA (Research on the Effects and Influences of the Nuclear Bomb Test Explosions, Jap. Soc. Prom. Sci., 1143-1150, 1950)

Among the fishes contaminated with the fission products, the most valuable species are tunas and marlins in the Pacific Ocean. And one of the most dangerous elements is supposed to be Sr^{90}. At this stand point, we tried the experiment to see the behavior of Sr^{90} in fish. Fishes used in this experiment were Jack mackerel *Trachurus japonicus*, mackerel *Scomber japonicus*, and blue fin tuna *Tunnus orientalis*. $Sr^{90}+Y^{90}$ solution was administered orally into the stomach by a elastic tube and by injection into the dorsal muscle of fishes. Fishes treated with Sr^{90} were kept alive in a crawl settled in open sea. From our results, a great part of absorbed strontium to fish body deposited on its hard tissues such as scale, vertebrae, fin and gill, behaving just as calcium does. And among soft tissues, liver, kidney and spleen obtained it a little larger than the others. In the muscle of fish, strontium was not found in most of the cases and in the cases where it was slightly found, the amount is about two hundredth of that of highest activity, and the ratio would be reduced if the hard tissue accumulate it. The methods of administration, which are injection into muscle, and oral insertion into stomach, didn't show much difference in the general mode of deposition, except that strontium remained in the digestive tube at the early period.

Table. The deposition of Sr^{90} in various tissues of the blue tuna by the injection into muscle (Figures are amounts of Sr^{90} expressed by the unit of $10^{-4}\mu c$. They were assayed in dry condition and converted into the amounts in 1 gr of wet tissue.

Time	30 h	34 h	50 h
Injected dose	1.6 μc	uncertain	2.4 μc
Pectoral fin	57.6	7.2	26.8
Skin	—	0.7	1.4
Scale	98.0	16.9	60.2
Muscle	0.4	—	0.3
Red muscle	0.9	0.2	0.3
Gill	41.4	6.0	39.0
Heart	1.5	0.2	1.6
Liver	2.3	0.7	4.1
Pyloric caeca	1.5	—	1.5
Stomach	1.1	0.3	1.1
Intestine	—	0.7	2.0
Spleen	2.6	0.8	3.1
Kidney	2.1	0.8	2.5
Vertebrae	32.6	3.9	24.3

74. Comparison of the method of decontamination of fission products from the materials of fishing gears of the Fukuryu-maru No. 5. Takaya KUSAKA (The Research on the Effects and Influences of the Nuclear Bomb Test Explosions, Jap. Soc. Prom. Sci., 1235-1243, 1956)

Materials used for the study on the method of decontamination of fission products were cotton cord of tuna long line, dyed with coal tar (dia. about 5 mm.) and attached wooden plate tag, not painted, as marks of the long lines (140×90×10.5 mm.) found on the board of Fukuryu-maru No. 5.

In the case of tarred cotton cord, when samples from the long line were only immersed in water or sea water radioactivity was reduced to about 20–40%. Removal was more effective when the sample was immersed in EDTA-Na salt or acetic acid solution, about 60–70%. Also, radioactivity was found in the liquids and solutions used in the decontamination tests to show that removals were effected. The mechanical method of decontamination by washing with brush proved quite effective. By washing with brush only once 50% of the radioactivity was removed. 9fter two washings decontamination was about 70% effective.

In the case of the wooden plate tag immersed in liquids and solutions, decontamination was about 40–50% effective (EDTA-Na salt or acetic acid solutions). However, washing by brush was not so effective because it had already been immersed in decontamination solutions in prior test and most of the surface radioactivity was removed in the initial immersion. On the distribution of radioactivity inside the wood tag, it is recognized that there is fairly large radioactivity from the surface till about 2.5 mm. though it decreases noticeably in the center area.

75. An analysis of the fish attracting effect of "Komashi" or fish attracting bait. Yoshio HIYAMA, Shiro YOSHIZAKI and Hisao NAKAI (Jap. Journ. Ichthyology **4**, 139-152, 1955)

"Komashi" is the bait to be scattered at the fishing spot to attract the fishes. The authors had been interested in "Komashi" to see what kind of chemical ingredient in them might have the alluring effect.

As the materials: a round and shallow (80 cm. deep) tank, 3.8 m. diameter, and surfaced by white tiles, so as to make the bottom easily seen from above. The tank was kept with fish schools of sardine, mackerel and hard-tail. In every case of feeding, a conspicuous aggregation of fish was seen to the spot where the food (salted Mysis) was thrown in by the feeders. The authors noticed that this also occurs by some other factors which are, human figure, stir in water, water current, light and time of day.

About 27 kinds of natural substances, prepared in various ways were tested to see the chemical attracting effect, so as to see any common ingredient among them, and at the same time to find out any substitute for "Komashi". The same type of experiments were made using 29 sorts of pure chemicals. To find out the effective ingredient contained in salted Mysis, the authors made a chemical analysis of the substance to test the effect of each fraction of it. Regarding on factors related with sense of vision, to see what size of bait the fish school would be attracted and what colour of the sample would have most attracting effect.

By the results of this series of experiments, the considerations are:—

"Komashi" has the effect to attract the fish by the presence of a water soluble substance and the presence of the figure of the substance itself. The fish school was conditioned to response to "salted Mysis", but they also responsed to the water extract of the other substance of natural product. Among the pure chemicals we tested, some of the amino acid had a slight attracting effect. So, the water extract of the natural products having the complex and various chemical ingredients, has more effect than any of the more simple or pure chemical property, as far as we tested. Regarding to the figure of the substances, the larger the size of the substance, and having the colour of white (green is the next, and blue and brown are the third) has more effect to attract the fish.

As this series of the experiments were carried out mainly for a practical analysis, to contribute to the improvement of fishing method, so the method we used was the direct observation method, but this result might bring some to the problem of the chemical sense of fish.

76. Change of the locomotion activity of fish with regard to the size of the tank. Takaya KUSAKA (Jap. Journ. Ichthyology **4**, 59-63, 1955)

These experiments were done to see the locomotion activity of gold fish, expressed by "frequency of transfer", in various sizes of the tank, which were obtained by changing a length of the same long tank by moving one septum from one end to the other of the tank. At first, whole length (150 cm.) of the tank was used and next by shortening the length, one by one the same tank was utilized as smaller four size tanks. (100, 75, 50 and 37 cm.) After these, the experiment was repeated in the reverse manner, starting with the length of 37 cm. the length of the tank was increased step by step to the original length of 150 cm. This one series of the experiments were repeated five times. Thus, it is recognized that the frequency of transfer has a fair straight line relationship with the length of the tank as shown in Figure. This relationship tells us that no effect of change of other environmental conditions happens during this series of experiments. And also, it is considered that the speed and the distance of the fish swimming around here and there is almost constant to the activity of fish. The speed of locomotion of fish school have been carried out as follows:

Speed of fish school $= \frac{1}{2} \times$ (width of tank $+$ length of tank) $\times$ frequency of transfer per school
$= 118 \pm 16$ cm./minute

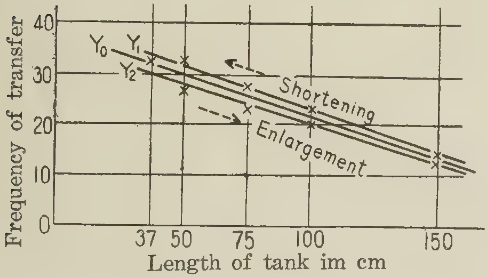


Figure The relation and the regression lines

×: Observed values.
Y_1: Regression line for the shortening.
Y_2: Regression line for the enlargement.
Y_0: Regression line, united with Y_1 and Y_2.

77. A method to determine the time of ring formation in hard tissues of fishes, especially for the age determination of Pacific tunas. Yukio NOSE, Sayako TOMOMATSU, Koya MIMURA and Yoshio HIYAMA (Rec. Oceanogr. Works in Japan **2**, 9-18, 1955)

In any case of age determination of fishes by hard tissues such as scale, bone, otolith and others, one of the basic problem is the season of the year in which the ring or mark that we are reading is formed.

The authors introduced a method to determine the time of ring formation using Fourier's analysis and described the results obtained from the method applied here for the scale of three Pacific tunas, albacore (*G. germo*), yellowfin tuna (*N. macropterus*) and bigeye tuna (*P. sibi*).

Theoretically, the index* of marginal increment widths in each individual is thought to be a right-angle triangle wave just like the *teeth of saw* having a period as one year, of which minimum is 0 and maximum is 1. However, the average index for numerous individuals resembles a sine curve in shape. (G(t) in Fig. 1) Such a phenomena can be caused by the individual variation of the phase of the above mentioned triangle wave.

Then, if we express the variation of phase of the triangle wave as $f(\tau)$, the probability density function, and the triangle wave as

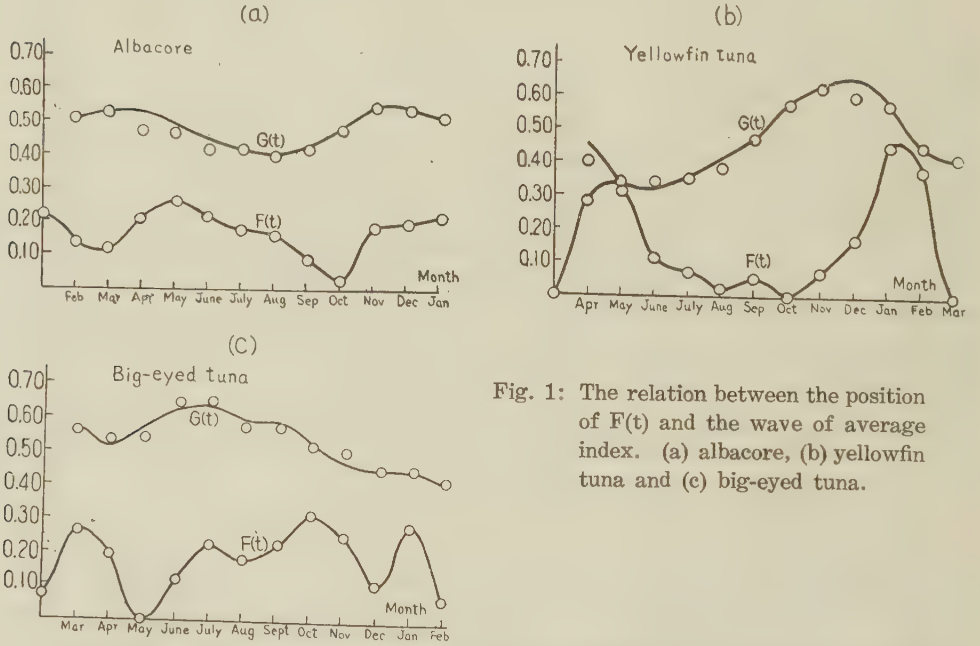


Fig. 1: The relation between the position of F(t) and the wave of average index. (a) albacore, (b) yellowfin tuna and (c) big-eyed tuna.

* If we express the index as $G(t)$,

$$G(t)=T-R_n\Big/\frac{R_n-R_{n-2}}{2},$$

where T is the length from focus to margin of scale, R_n is the distance from focus to the n_{th} ring (the most outer) and R_{n-2} is the distance from focus to the $n-2_{th}$ ring.

$$H(t) = \frac{1}{2} + \frac{1}{\pi} \sum_{n=1}^{\infty} \frac{(-1)^{n-1}}{n} \sin nt,$$

we get easily $f(\tau)$ by developing the $G(t)$ in Fouriers series.

Furthermore, from $f(\tau)$, above acquired, we can know $F(t)$, the proportion of the number of individuals which form a ring at a certain month of a year.

The results thus obtained applying it for three Pacific tunas are summarized as follows.

(1) As shown in Fig. 1, the maximum point of $F(t)$, which means the most numerous individuals make the ring at that time, does not correspond with the minimum of $G(t)$ which has been thought to be the time of ring formation by previous workers.

(2) There is some possibility that these tunas in the Pacific may have some groups having different time of ring formation in scales each other.

78. Transmission and metabolism of strontium 90 in aquatic animals. Yasuo Suyehiro, Shizuo Yoshino, Yoshikazu Tsukamoto, Motohiko Akamatsu, Kozo Takahashi and Takajiro Mori (The Research on the Effects and Influences of the Nuclear Bomb Test Explosions, Jap. Soc. Prom. Sci., 1135-1142, 1956)

This report describes the result of the fundamental study to endorse the practical problems, how fieshes and other aquatic animals are contaminated by hydrogen or atomic bomb explosions. In this series of experiments Sr^{90} (containing Sr^{90} and Y^{90}, hereinafter called Sr^{90}) was used.

(1) Absorption of Sr^{90} by fish from medium.

Absorption of radioactivity from highly radioactive medium ($Sr(NO_3)_2$ solution containing Sr^{90} was diluted to 1/100–1/1000 with distilled water) to Japanese killifish body recorded a remarkable increase for the first 24 hours and a little increase after 48–72 hours. On the contrary, in case of very slightly radioactive water, absorption of radioactivity of fish body took longer time.

(2) Absorption of Sr^{90} through digestive tract.

Radioactivity was detected on several organs with foods containing Sr^{90} injected into their digestive tract. The experiment using many kinds of fresh and marine fishes showed that the amount of radioactive materials absorbed through digestive tract was very small, although there was considerable individual difference.

(3) Fluctuation of Sr^{90} in blood.

The fluctuation in the amount of Sr^{90} in the blood of eels, *Anguilla japonica*, weighing 50–100 gr under which skin 0.5 cc of physiological salt solution containing radioactive $Sr(NO_3)_2$ (pH 7.0 12 μc/cc, 40,000 cpm/cc) was individually injected, was checked. Even after 13 days, there was still an existence of Sr^{90}.

The fluctuation of Sr^{90} in the serum, separated from coagulated blood, was shown; (i) almost all part of Sr^{90} subcutaneously injected was transmitted to the circulation of the blood within an hour, (ii) the amount of Sr^{90} in the blood decreased remarkably for the succeeding 24 hours, and (iii) it continued to fluctuate till it settled nearly at the constant level after about 164 hours (7 days).

The amount of radioactivity in blood cake was far smaller than in the serum. From this fact it seems to be that serum plays an important role in transmission of Sr^{90} in the body.

(4) Absorption of Sr^{90} by clams and crustacean from the medium

Radioatcivity was detected in every internal organs saving shells in the case of clams, and rapid absorption was observed in the case of fresh water shrimp.

79. Effects of radioactive materials upon blood-pictures of fish. Yasuo SUYEHIRO and Takashi HIBIYA (The Research on the Effects and Influences of the Nuclear Bomb Test Explosions, Jap. Soc. Prom. Sci., 1231-1232, 1956)

The sensitivity of the hemopoietic tissue to radiant rays is well-known in the case of various kinds of mammals. In order to clarify the effects of radioactive materials upon blood-pictures of fish, the study reported here was made.

Gold fish were injected with solutions containing Sr^{90} at the rate of 0.031 μC/gr in body weight, and at fixed intervals of time three fish amongst them were collected in order to count their blood cells. The result indicated that the correlative figure between leucocyte and erythrocyte began to decrease two days after injection, and that it was a minimum on the fourth day. In the components of leucocyte, an increase in the number of lymphocytes was seen after 24 hours and a decrease in the number of neutrophil was found on the contrary.

Besides, the change expected to appear in blood-pictures of the carp which were bred in Sr^{90} solution (0.94 μC/1) was traced. Any remarkable change was not observed there.

80. Effects of fission materials upon the development of aquatic animals. Takashi HIBIYA and Teiji YAGI (The Research on the Effects and Influences of the Nuclear Bomb Test Explosions, Jap. Soc. Prom. Sci., 1219-1224, 1956)

The effects of radiation, especially by relatively smaller amount of radiant rays upon the development of some aquatic animals were studied. The radioactive materials employed were Sr^{90} and the water extracts of the ash which was produced by the test explosion of nuclear bomb at Bikini atoll in March, 1954, collected from the deck of the fishing boat, "Fukuryu-maru No. 5". The materials used were summer eggs (asexual eggs) of two different species of water fleas, *Daphnia pulex* and *Moina macrocopa*, and eggs of teleosts, *Pseudorasbora parva parva* and *Oryzias latipes*.

The daphnian eggs were treated while they were holding on to their mothers' brood-chambers, and the observation was made till their hatching out and being released from the brood-chambers. As for stages from which the eggs were treated, the results obtained indicates a trend that the earlier it is, the higher frequency of abnormal and dead eggs. Abnormality observed were diverse, of which most were of underdevelopment and some were of crooked or shortened antenna and some were of extremely crooked shell spines. There was hardly any difference in frequency of abnormal development between two spcies, and also among several kinds of media varying in the extent of radioactivity (62-4,016 cpm/cc.)

Teleostean eggs were treated in the media containing "ash" extract, and continuous observation was made till the commencement of independent life as larval fish. Various kinds of abnormal development were observed on the eggs, namely weak squirming of embryo, crooked body, shortened body length, decrease in number of myotomes, underdeveloped fins, delay in hatching, abnormal appearance of chromatophores and etc. were seen in various extents of combinations.

81. On the sexual maturity of the sperm whale (*Physeter catodon*) found in the North Pacific. Masaharu NISHIWAKI, Takashi HIBIYA and Seiji KIMURA (Sci. Rep. Whales Res. Inst. **11**, 39-46, 1956)

Since 1954, sperm whale-fishing have been operated by Japanese whaling fleets in the waters near the coasts of Aleutian Islands. The authors studied the sexual condition and the sexual maturity of the school of sperm whales taken in the coast of Aleutian Islands and comparing it with that in the adjacent waters of Japan (NISHIWAKI and HIBIYA, '51, 52). The former consist of lone bulls. And by the investigation of the testis sampled from the school, it is estimated that the testis becomes mature at the average weight of 1.1 kg., and almost individuals over 38 feet in body length attain sexual maturity. It is not clear that from where the school migrates, but when we compare the school with that found in the waters close to Japan, there is no difference in the two. The above mentioned body length is smaller than the body length at which the male sperm whales in the Antarctic waters attain sexual maturity.

82. Descriptions on unidentified species of Dibranchiate Cephalopods. I. An Oegopsiden squid belonging to the genus *Architeuthis*. Eiji IWAI (Sci. Rep. Whales Res. Inst. **11**, 139-151, 1956)

Nothing new having been studied on the pelagic species of Cephalopods in the sea around Japan, since the report by Dr. M. SASAKI (1929), it is believed that many unidentified species still exist in the ocean.

The present specimens belonging to Oegopsida examined have not been hitherto catalogued in Japan. In many respects, these specimens resemble the squids of the genus *Architeuthis* and it is thought to be a young type of *A. japonica*, but on the other hand, striking differences were seen. In this paper, the author has tried to describe the two specimens, by discussing their resemblances and differences with *A. japonica* and other Oegopsida.

The samples were found in the digestive canal, perhaps in the stomach of the sperm whale, captured near the Bonin Islands in the summer of 1952. The measurements are 92 mm and 104 mm in the dorsal length of the mantle.

Many points agreed with the descriptions of *A. japonica*, are (1) in the external appearance of the mantle and the fin, (2) the structure of the articulating cartilage, (3) in the arrangement of suckers on all arms, (4) the basemental structure of the tentacular club and its stem, and (5) the fixing apparatus. But on the contrary, remarkable differences were also seen and are summarised in table 1.

Table I.

	A. japonica (adult)	The specimens
Hand region of tentacular club	consists of 4 rows of suckers	consists of 5 rows of suckers and ones of the central row much larger than the other
Arms	much longer than body length and arm formula; $4 \doteqdot 3 > 2 > 1$	not longer than body length and arm formula; $2 \doteqdot 3 > 4 > 1$

Horny rings of arm suckers	all with dentation	not any teeth
Fin	decidedly longer than breadth	length shorter than breadth
Gladius	forms an end-cone at the posterior extremity	does not form

In addition to this, some of the results, established by the comparision of these samples with *A. japonica*, seem also to be applicable to other species of this genus. Still more, from other families, differences were clearly recofnized at a glance. Twelve figures are listed.

II. A Cranchiidae squid of the genus *Taonius*. Eiji IWAI (Sci. Rep. Whales Res. Inst. **11**, 153-161, 1956)

An interesting deep-sea squid was given to the author. From a number of characters, the sample belongs definitely to the genus *Taonius* of the family Cranchiidae. As the author, however, is not aware of any literature of this specimen itself, he has made an effort to describe the observations in details on this unidentified species, comparing it with the known species *T. pavo.*

The sample was obtained from the stomach contents of the sperm whale caught near Kamchatka in the North Pacific in the summer of 1951. The ventral length of the mantle is 428 mm by measure.

That the specimen is believed to be the only species of this genus ever found, is from the following reasons: (1) Body is most elongated. (2) Length of mantle, fin, head and arms is proportionately similar to that of *T. pavo.* (3) Gelatinous texture of body constitution. (4) Non-stalked large eyes. (5) Structure of lanceolate gladius.

On the other hand, marked differences with *T. pavo* were also seen as shown by the following characters. (1) Existence of white tubercles and variable pigment spots on the surface of the mantle. (2) Presence of three kinds of teeth on the horny ring of each arm sucker and its number. Namely, the proximal horny ring has 3 to 5 square-cut teeth, set closely by each other with deep crests. The central one is provided with 7 to 12 teeth, being much broader and shorter than the former. While, on the distal horny ring, the number of teeth is considerably decreased to $4 \sim 6$ and its form becomes conspicuously sharp and triangular in shape. (3) Absence of olfactory tubercles. (4) The curious tongue-like shape of the funnel and its vertical opening.

Among these, it is most notable fact that the specimen has calcium hyaline tubercles which are not found in other *Taoninae* squids and appearance of them suggests the close phylogenical relationship to the *Cranchiinae* squids. 6 figures are listed.

83. Notes on a rare species of Cranchiids squid. Eiji IWAI (Bull. Jap. Soc. Sci. Fish. **21**, 1210-1214, 1956)

A rare squid belonging to the genus *Galiteuthis* is described. This specimen was found in the first stomach of a sperm whale caught on June 30th, 1952 at 40° 10′N, 147° 10′E in the North Pacific. Comparing it with known species of the same

genus, many differences were noted.

Its main characters are as follows:

(1) Mantle is not protruded posteriorly beyond the fins as described in SASAKI's and BERRY's descriptions. (2) Fins are markedly larger and firmer than those of all other species. In this specimen, the length of fins reaches 62% of mantle and the breadth is 42% of the length; these values are about 10% higher than those of previous species. (3) Each arm is also longer more than twice than that of known species. (4) Hand portion of tentacular club is composed with 13 delicate hooks in two rows, which three-lobed curious structure agrees with BERRY's description and differs much from that of JOUBINS. (5) Fixing apparatus consists of 9 suckers and 10 pads, situated next to each other, and its arrangement resembles somewhat that of *G. phyllura* and not *G. armata.*

Judging from the above mentioned characters, the genus *Galiteuthis* may be divided into two forms—Pacific and Atlantic—as stated by PFEFFER for the Archi-teuthidae. In any case, this species not having been reported from the North Pacific except for SASAKI's description on the species from off Kamchatka, is a very remarkable addition to the fauna of the waters adjacent to Japan.

Furthermore, the fact that this apparently deep-sea squid was taken in the stomach of a sperm whale, may give a suggestion as to the vertical distribution of the whale.

84. Some examples of large male eels. Nakaroku NAKAMURA (Aquiculture **3**, 56-57, 1955)

It is well known that the male is smaller than the female in the eel, and that a male over 50 cm. in body length is very rare in the European eel. MATSUI recently reported that the Japanese eel attains a greater maximum size than the European eel in either sex, especially in the male, and that th largest male of the Japanese eel he had ever measured was ca. 57.5 cm. in body length.

Since 1940 the author has examined ca. 450 specimens of the Japanese eel of the blank eel stage captured in the brackish fish ponds in Atsumi-cho, Aichi Pref., and have found 7 males larger than 60 cm. The largest specimen measures 70.3 cm. in body length; its age is estimated at 9 years (as counted from the glass eel stage) on the basis of the rings in the otolith.

85. A study on the phenomenon of the Tobi-Koi or shoot carp II. On the effect of particle size and quantity of food. Nakaroku NAKAMURA and Shogoro KASAHARA (Bull. Jap. Soc. Sci. Fis. **21**, 1022-1024, 1956)

As a part of a series of experiments to determine how and why the shoot carp occur, carp fry, a few days after hatching were reared with food of different particle sizes and quantities. Their body length distribution was analyzed with the following results.

(1) Body length distribution is approximately symmetrical in the batch of fry fed with small particle food (cladocerans passing through the 400 mesh), but skewed conspicuously in the batch fed with larger particles (cladocerans and mosquito larvae), indicating the occurrence of the shoot carp.

(2) When comparative batches of fry are given the same food in different

quantities, the shoot carp occur, i.e. the length distribution is skewed with the mode in smaller length, more conspicuously in the batch fed with "difficient" quantity of food than in those given "moderate" or "plentiful" quantity.

These results seem to indicate that competition for food between the individual fry within the batch is an important causuative factor of the occurrence of the shoot carp.

86. Marking experiment on the glass-eel of *Anguilla japonica*. Shogoro KASAHARA (Aquiculture **3**, 44-43, 1955)

The glass-eel was successfully marked by the vital staining in the 10–30 p.p.m. neutral red solution in brackish water. Glass-eels immersed in this solution for 3–5 hours are stained red, and are well distinguishable from unstained individuals for at least two weeks following staining, though the color fades away with the elapse of time.

By applying this marking method, the author studied the movement of glass-eels in Fukue Bay, Aichi Pref., during the winter 1954–55. The bay is nearly oval in shape, 3.7 km. (east-west) by 1.8 km. (north-south) in size, and opens towards north with a narrow passage.

Marked glass-eels were released at a point in the bay in the early afternoon. A dip net attended with a fish attracting lamp was operated every night at the collecting station on the east coast, which caught marked eels as well as non-marked eels.

Three experiments were carried out in this way, marked eels being released at different points each time. In every experiment, the recapture of marked eels began on the first night following the release and continued for 2 to 3 weeks, while daily recapture recorded the peak within a few days following release.

From the results of these experiments (see Table), it is estimated that about 30% of the glass-eels that have entered the bay arrive to the collecting station via "Nakaze".

Place of release	East coast (115 m. from collecting station)	"Nakaze" (Between bay mouth and collecting station)	Near bay mouth
No. of marked glass-eels released	590	2000	1700
Duration of recapture	16 days	20 days	14 days
Percentage recapture	19.8% (10% on the first night)	12.3%	3.4%
Maximum recapture occurred on	1st night	2nd night	3rd and 4th night

87. On the amount of the radioactive ash fallen on board the Fukuryu-maru No. 5 on March 1, 1954. Yoshiyuki MATSUE (The Research on the Effects and Influences of the Nuclear Bomb Test Explosions, Jap. Soc. Prom. Sci., 993-996, 1956)

When the Fukuryu-maru No. 5 returned, there remained no apparent traces of the radioactive fall-out, so-called "Bikini ash," on any outdoor places of the ship macroscopically, though very strong radioactive contamination was proved every-where.

So, there were no means available to evaluate the quantity of the radioactive ash fallen on her.

At the beginning of June, 1954, when an inspection was made by a group of scientists, a diving mask was found on a shelf in the steering room of the ship. On the surface of its window glass a small amount of pure white radioactive ash was observed clinging sparsely as if it was scattered over. The implement was seemed to have been layed ther untouched since the accident on March 1, 1954.

The quantitative determination of the ash was tried by the author and the results are that the amount of the ash equals to ca. 5 g/m^2 in weight and to ca. 70×10^6 cpm/m^2 in radioactivity as the value on June 18, 1954.

These values by no means show us the true amount of the fall-out on outdoor places of the ship, but it has a meaning in indicating to us how much fall-out blew into the room through windows and doors of the room which must have remained open then. At least, it may be possible to suppose that the true amount of the fall-out at the position of the ship, 90 miles off the Bikini Atoll, must have been far more than the value as above obtained.

Based on the result, the radioactive contamination on sea water near Bikini Atoll due to fall-out was discussed in the report.

88. **Accumulation of radioactivity in plankton cultured or kept in water infusions of the "Bikini Ash".** Yoshiyuki MATSUE and Reijiro HIRANO (The Research on the Effects and Influences of the Nuclear Bomb Test Explosions, Jap. Soc. Prom. Sci., 1099-1104, 1956)

Radioactive dust collected on board the Fukuryu-maru No. 5 was extracted with fresh water or sea water and strong radioactive solutions were obtained. In our experiments several species of plankton algae and animals were cultured or kept in the solutions and their accumulation of radioactivity were determined. In these solutions, however, unequalities in the components of radioactive elements are expected undoubtedly, and so the amount of radioactivity alone was considered here.

When phytoplankton were cultured or kept in these extracted solutions of radioactive dust, they accumulated radioactivity rapidly. The results was similar even when the culture was carried out in a dark place. Zooplankton accumulated radioactivity both through radioactive diet and directly from the surrounding water. But on the accumulation through radioactive diet, only small portions of radioactivity from the diet algae was retained in animal body. The accumulation of radioactivity by the organisms above mentioned, however, does not necessarily mean the assimilation or the absorption of radioactive elements by the organisms. Because radioactive elements in the extracted solutions have a character to be also easily adsorbed on solid surfaces and their character has a great meaning upon the accumulation of radioactivity by any organisms. On the liberation of radioactivity from organisms returned to normal water, only two species, *Chlorella sp.* and *Daphnia sp.* were experimented. It was shown that the liberation of radioactivity from phytoplankton (*Chlorella*) is rather slow while zooplankton (*Daphnia*) liberate it very rapidly.

89. **Observations on the so-called deep scattering layer (D. S. L.), with special reference to the vertical distribution of plankton.** Yuzo KOMAKI and Yoshiyuki MATSUE (Journal of the Tokyo University of Fisheries **42**, 139-150, 1956)

With the collaboration of Dr. UDA (Prof. of Tokyo Univ. of Fish.) and many

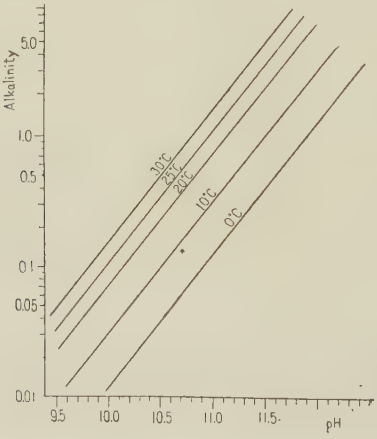
other colleagues, we studied the peculiar characteristics of the deep scattering layer (D.S.L.) which scatters ultra-sonic sound and migrates vertically with diurnal periodicity. Throughout the eight investigations carried out in the adjacent sea of Japan, we were especially in charge of the study on the correlation between the vertical distribution of macro-plankton and the scattering layer.

The scattering layer was detected not only in the open sea but also in the coastal waters such as Beppu Bay and Suruga Bay. From the results of our observations, it was hardly possible to find the direct correlation between the scattering layer and the vertical distribution of plankton. But it can be pointed out that there are some interesting characters in the scattering layer.

The scattering layer could not be detected in the oxygen lacking bottom layer at Beppu Bay. This is a strong proof to explain that the scattering layer must be constructed of animal crowd. And in many occasions, it was in the regions of the bank, continental slope, margin of current or current rip that the scattering layer was detected. It has been known that in such regions plankton or other marine organisms are propagated or accumulated abundantly. The scattering layer was apt to be apparently detected by about sunrise or sunset. It seems probable that this character of the scattering layer has some connections with the behaviour of plankton or other marine free-living organisms, to make dense crowd at twilight. The vertical migrations of the scattering layer were observed in the morning or in the evening. It migrates with the speed of about 0.9 to 3.0 m/min., i.e., within the range of value ever reported as the speed of vertical migration of zooplankton by many authors.

90. On the relation between carbon dioxide supply and phytoplankton growth. Yoshiyuki MATSUE and Reijiro HIRANO (Jap. Journ. Limnol. **17**, 133-140, 1955)

Although considerable attention has been paid to the limiting factor on phytoplankton growth and many studies have been made about it, we have as yet very little information as to the relation between carbon dioxide supply and phytoplankton growth. So the present study was designed to secure this information. The results obtained are summarized as follows:



Graph showing the relation between alkalinity and pH when the content of total carbon dioxide is absent.

(1) The relation between alkalinity and total carbon dioxide at various hydrogen ion concentrations was calculated. Also, the relation between pH and alkalinity was calculated when the total carbon dioxide contained in the water was wholly assimilated by the phytoplankton. The result is shown in figure. From this figure, it seems possible, that only by the measurement of the pH and alkalinity we can detect whether or not carbon dioxide supply is a limiting factor on phytoplankton growth.

(2) The common planktonic alga, *Scenedesmus obliquus* was cultured in the media of different alkalinities, and during this cultivation daily changes of pH and water temperature were observed. Each maximum value of pH obtained in this experiment agrees with the theoretical values that are calculated, supposing the phytoplankton consumed the total carbon dioxide wholly.

91. Investigation on the origin of the shellfish poison. Yoshiyuki MATSUE (Investigation on the Origin of the Shellfish Poison and Some of its Phenomena, Hosei Univ. Press, 21-35, 1955)

Some important Japanese shellfish (*Ostraea* and *Venerupis*) are known to become poisonous at the restricted areas in definite seasons, though not every year. The poison was proved to be much different in toxic action from that of mytirotoxin in mussel and it was named venerupin.

To find out the origin or the origins of the shellfish poison, investigations have been continued by the author since 1942, but in vain. The negative results on many culture experiments and also on the plankton research around the poison district are described in the report.

92. Absorption and metabolism of fission products in goldfish. Aritsune SAEKI and Kazuo SANO (Research on the Effects and Influences of the Nuclear Bomb Test Explosions, Jap. Soc. Prom. Sci., 1105-1117, 1956)

We performed the experiments on the absorption, distribution, excretion and some biological effects of fission products upon goldfish (*Carassius auratus*, LINNE) using the ash which was gathered from Fukuryu-maru No. 5.

The results of the experiments are as follows.

(1) When goldfish was cultured in water containing fission products of the ash of Fukuryu-maru No. 5, the radioactive substances were absorbed through both the gills and the digestive tract of the fish in a short time.

(2) When the hydrochloric acid solution of the ash was diluted or neutralized, radioactive substances were precipitated. The radioactive precipitate was taken up through the digestive tract of the fish, and the water soluble radioactive substances of fission products were absorbed or transmitted through the gills.

(3) When fission products are fed, goldfish soon becomes radioactive.

(4) Some substances contained in the water, for instance EDTA (disodium-ethylen-diamine-tetra-acetic-acid) and silicate, effect goldfish to absorb or excrete radioactive substances of fission products by making some chemical compounds with them.

(5) Goldfish does not lose the absorbed radioactive substances any faster than that attributed to decay alone.

(6) It is suggested that the melanosis of goldfish might be caused as the result of culturing it, in water containing fission products or radioactive strontium.

93. Preliminary studies on the removal of radioactive substances from polluted waters by biological methods.—On the capacity of water bacteria for adsorption of fission products. Nobuo TAGA (Research on the Effects and Influences of the Nuclear Bomb Test Explosions, Jap. Soc. Prom. Sci., 1245-1250, 1956)

The present paper is devoted primarily to a study on the removal or adsorbing capacity of radioactive substances or fission products by water bacteria, which have been considered to play an important role in such biological waste treatment processes as the activated sludge and trickling filter. In this experiment the real fission products of Hydrogen-atomic Bomb Explosion at Bikini Atoll, i.e. the "Ash" collected on the deck of the Fukuryu-maru No. 5, were used as sources of radioactive materials. The bacterial strains used in this experiment were the mixed ones of marine bacteria isolated from crude sea water and the sewage bacteria isolated from the activated sludge and the surface film of trickling filter at the sewage disposal plant.

In conclusion of the experiment, it may be stated that the water bacteria or their slimy growths have adsorption capacity for radioactive substances in polluted waters. But it seems that the extent of such capacities varies not only with the sorts and properties of the radioactive substances in water but also with the kinds and characteristics of the water bacteria. Consequently, such biological treatment systems as the activated sludge or the trickling filter, in which the microbiological function may play an important role, should be effective for the treatment of radioactive wastes.

Moreover, it might be suggested that sand filtration was effective as a handy decontamination method for tap water contaminated slightly with radioactivity, because about 80 per cent of fairly strong radioactivity of the water could always be removed by the simple sand filter.

94. Studies on water pollution problems by the wastes from the preparation of coal and ore. Nobuo TAGA (The Aquiculture Series, Fisheries Agency of Japan **4,** 1-60, 1955)

The present paper is devoted mainly to report the results of the research on the polluted conditions of rivers and coastal area in Ibaragi Pref., around the Jōban Bituminus Coal Region, in which there are about thirty-five coal mines. In the last part of this report, it is also discussed that the occurrence and the distribution of the "green-oyster" in the coastal regions of Hitachi City would be attributed to the discharge of the waste waters from the preparation of the ore, in the ore mine located there.

The detailed contents discussed in this paper are as follows:—

(1) Objects and benefits of the preparation of coal.

(2) General views of the waste disposal problems in the coal mining of America.

(3) Polluted conditions of the rivers located in the Jōban Bituminus Coal Region.

(4) General properties of the waste water from the preparation of coal.

(5) Disposal and treatment procedure of the waste water from the preparation of coal by the coagulation method (as a counter-plan for its water pollution).

(6) State of the damages as a result of pollution by the waste water of coal mines on aquatic organisms and coastal fisheries.

(7) Discharge of the waste water from the Hitachi Ore Mines and its relation with the occurrence of the "green-oyster" in the coastal regions.

(8) General conclusion for a counter-plan on the pollution problems.

95. On thd wasting diseases of cultured laver and the counterplan. Seibin ARASAKI (Plant Protection, Japan **10**, 243-246, 1956)

There are several kinds of diseases which bring a short crop of cultured laver, *Porphyra tenera*, through different origins and symptoms. They are classified into non-parasitic (physiological), parasitic, and diseases of unknown origin.

As to the non-parasitic or physiological diseases, the 'White Wasting Disease' is most harmful, and the 'Perforating Disease, is second.

'White Disease' is caused from physiological disorder of the frond, on account of an insufficient emergence out of water during early winter season especially of an unusually warm weather. As the sea level in ebb-tide in the day-time becomes much higher in winter than that in autumn (fig. 1), the laver-fronds which have grown on the autumnal level become susceptible to the disease. The disease prevails almost every year during from middle November till middle December.

'Perforating Disease'' is caused by mechanical injure and hypotonic osmose action of dilute sea water which contain abundant fine granules of silty sand (according to Nozawa). The disease occurs usually during from early November till late December in the places near estuary, especially after a heavy rain or a heavy storm.

As to the parasitic disease, the 'Red Wasting Disease' is most harmful and inflicts severest damage on laver crops.

The cause of the diesase is chiefly parasitism of a fungus, *Pythium n. sp.* The mycelia grow intramatrically within the host in all directions, penetrating and killing the cells invaded, and produce simultaneously many grobular sporangia outside the host. Discharged zoospores swim about, and attack a new host immediately after germination. They grow rapidly and produce many spores in such hydrographical conditions as the temperature of sea water is higher than 10°C, especially between 12–15°C, and the chlorinity lower than 10‰, among these the temperature seems to be most influential. When the temperature goes down lonwer than 10°C the mycelia stop to grow and produce intracellularly oogonia and antheridia. So the disease spreads vigorously in the suitable conditions of higher than 10°C, and ceases at lower than 10°C. The mycelia, moreover, cannot endure to a longer descication for more than 6 hours, and the growth is considerably checked even by 2 or 3 hours' descication.

A field test on usual fungicides, such as $CuSO_4$, Hg-salts, marachite-green, crystal-violet and so on, have not yet had any satisfactory results to control the disease.

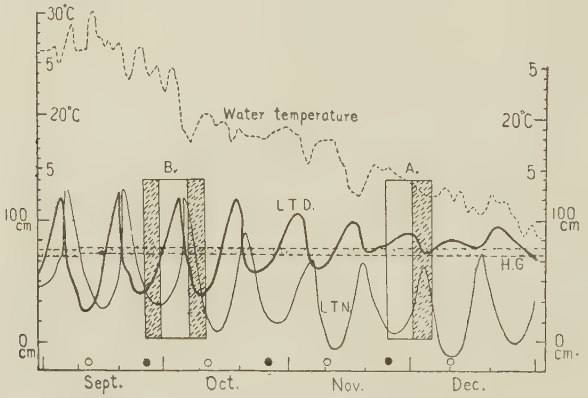
As to the disease of unnkown origin, a 'Leaf Wither with Cancer-like-feature' called Chirimen, Chijimi, or Fuka, and the 'Young Shoots Rot' called Me-itami or Kome-itami, are noticeable.

The former often occurs in somewhat definite places either along an estuary which contains some poisonous matters (according Fujiyama), or where the water is apt to stagnate.

The latter occurs at a somewhat definite period from middle October till late November, especially when the weather is rainy in October and very calm in November.

In such atmospheric conditions, the water is rather more diluted than the same season of an usual year.

In order to control these diseases, the best practice to prevent from damages is, for the present time, to raise the collector (Hibi) upto the hight where laver-fronds may emerge out of water for about 3 or 4 hours even in ebb-tide in the daytime during early winter season.



H.G.: the height of the growing belt of laver in autumn.
○: full moon.
●: the first day of a lunar month. (1954 in Tokyo-harbour).

Fig. 1. Correlation between daily variation of water temperature and low-water line when separated in the day-time (L.T.D.) and the night-time (L.T.N.), and the attachment of laver-spores (B) and the occurrence of disease (A).

96. On the relation between the appearance of spores of the laver (*Porphyra tenera*) and the environmental conditions II. Seibin ARASAKI, Toraya FUJIYAMA and Yunosuke SAITO (Bull. Jap. Soc. Sci. Fish. **22**, 167-171, 1956)

An investigation to find out the best conditions for setting collectors of *Porphyra*-spores was carried out for about a month from late September till early November, through the following experiments and observations.

1. Daily observation on the vertical change in temperature and chlorinity of sea water in about one meter intervals from the surface to the bottom. The air temperature and wind velosity were also recorded.

2. Counting laver-germling appeared on collectors which have been set every day in the sea.

3. Counting of laver-spores liberated from the *Conchocelis* which have been submerged every day after oversummering in the laboratory.

Judging from the results obtained, it is concluded that: 1. the spores are apt to appear in large quantities within a few days after the occurrence of vertical turbulace of sea water, 2. hydrographical and atmospheric conditions have some influence on the liberation of spores from *Conchocelis*, 3. correlation between the appearance of spores in nature and the liberation of spores from *Conchocelis* experimentally submerged in the sea, is noticeable.

97. A study on the influence of some environmental factors upon the development and maturity of the *Conchocelis*-phase of a laver, *Porphyra tenera* KJELLMAN. Yunosuke SAITO (Bull. Jap. Soc. Sci. Fish. **22**, 22-29, 1956)

The present study was carried out to clarify the influence of such environmental

factors as chlorinity of sea water, burying in the mud, and desiccation in the air, on *Conchocelis*-phase of a laver, *Porphyra tenera* KJELLMANN.

Results are as follows:

(1) In dilute sea water (10‰ Cl or below) the development of carpospores into the *Conchocelis* is retarded and disturbed.

The development of the *Conchocelis* which has penetrated into the oyster shell is almost unaffected by low chlorinity, although some delay in growth is observed in its younger stages. The formation of sporangia on the *Conchocelis* is delayed by low chlorinity.

(2) When the *Conchocelis* is buried in various bottom substances, it stops to grow. If it is returned to a normal environment after a short period of burying, it can grow further and become mature. But it cannot persist long in the mud or muddy sand which are rich in organic matter.

(3) The *Conchocelis* is fatally affected by desiccation and direct sunlight when they are exposed in the air. It dies in about 15 minutes outdoors and in about 30 minutes indoors.

98. On the liberation of spores from the *Conchocelis* of *Porphyra tenera* in the sea. (Preliminary report) Yunosuke SAITO (Bull. Jap. Soc. Sci. Fish. **21**, 1215-1218, 1956

It has been reported, on the basis of indoor experiments, that the liberation of spores from the *Conchocelis* of *Porphyra tenera* is greatly affected by water temperature and illumination, and is like to occur mainly in the early mornings.

With the view of ascertaining whether such is the case also in the sea, the following experiments and observations were carried out:

(1) The *Conchocelis* penetrating in oyster shells were submerged in the sea on September 20, after having been cultured indoors through the warmer season. On Sept. 26, Oct. 6, 9 and 16, the material was placed before daybreak in the glass tube with a glass slide at the bottom, and suspended in the sea. After a period varying from one to two hours, the *Conchocelis* was transfered into another tube of the same design. The process was repeated several times until sunset.

The tubes from which the *Conchocelis* had been removed, were set still in the laboratory for two hours, so as to let the spores liberated sink down onto the slide at the bottom. Then the spores were counted.

(2) In the mean time, hydrographical and atmospheric conditions were observed.

The results of these experiments and observations suggest that the liberation of spores is apt to be accelerated by the rise of water temperature and the increase of illumination. These two conditions, however, are not always sufficed in the sea immediately after sunrise, and the time of liberation of spores is variably affected by certain other hydrographical (tidal pahse, turbidity of sea water, etc.) and weather conditions.

99. On the relation between the appearance of spores of the laver (*Porphyra tenera*) and the environmental conditions. I. Yunosuke SAITO (Bull. Jap. Soc. Sci. Fish. **21**, 226-228, 1955)

It is said that the appearance in the sea, as well as the attachment to collectors, of the spores of the laver (*Porphyra tenera*) is greatly affected by hydrographical and meteorological conditions. With the view of clarifying this problem, following

experiments and observations were made in autumns 1951–54 in Ise Bay.

1) Daily collection and enumeration of the spores suspending in the sea, from late September through early October.

2) Setting up bamboo-twig collectors daily in the sea for about a month from late September, and enumerating the germlings appearing on them ten days after setting up twigs.

3) Daily measurement of the temperature and chlorinity of sea water at 1–2 meter vertical intervals at a station 6 meters deep at high tide, the data being analyzed with reference to the diurnal mean ranges of tide computed from the tide gauge records at Nagoya Harbor.

The results of these experiments and observations indicate that the spores of the laver are apt to get afloat in greatest numbers within the one to five days period following the occurrence of such vertical turbulance in the sea water as are caused by wind or tidal movements.

100. Studies on the radioactivity of fishes caught from the Pacific Ocean in 1954. Masamichi SAIKI, Shizuo YOSHINO, Riyushi ICHIKAWA, Yoshio HIYAMA and Takajiro MORI (Research on the Effects and Influences of the Nuclear Bomb Test Explosions, Jap. Soc. Prom. Sci., 825-839, 1956)

A survey of the radioactivity possessed by various species of fish caught from the Pacific Ocean in 1954 was inaugurated. The radioactivity of several tissues from thirty eight fishes contaminated radiologically is explained in the paper.

The most radioactive parts were liver, kidney, spleen, pyloric caeca, stomach content, stomach and rectum; gill and heart also contained considerable amounts of radioactive substances. On vertebrae, ovary and testis, slight radioactivity was detected. The radioactivity of muscles was very poor, the red muscle held always much higher radioactivity than the ordinary muscle of the same fish.

101. Studies on the radioactive material in the radiologically contaminated fishes Takajiro MORI and Masamichi SAIKI (Research on the Effects and Influences of the Nuclear Bomb Test Explosions, Jap. Soc. Prom. Sci., 889-894, 1956)

The existence of radioactive substances was proved in the muscle of several fishes, but the activity of muscle was very low in comparison with those of viscera of the same fish. The red muscle always held much higher radioactivity than the ordinary muscle of the same fish.

With water or EDTA-Na solution, some amount of radioactive material was effectively washed off from the raw meat.

The radiochemical analysis on ashes of fishes was inaugurated, and the radioactive substances of fishes were proved to be chiefly consisting of the radioisotopes belonging to III group, whereas those belonging to IV group (Sr, Ca, etc.) were relatively little. Members of III group were further separated in A (Al, Fe, etc.) and B (Zn, Co, Ni, etc.) sub-groups, and the latter fraction also contained considerable amounts of radioactive materials.

It is noticeable that Zn^{65} was detected in this III B group by the gamma-ray analysis.

102. Studies on the distribution of administered radioactive zinc in the tissues of fishes. Masamichi SAIKI and Takajiro MORI (Bull. Jap. Soc. Sci. Fish., **21** [8], 945-949, 1955; Research on the Effects and Influences of the Nuclear Bomb Test Explosions, Jap. Soc. Prom. Sci., 1205-1208, 1956)

When the clam, *Meretrix meretrix luzoria*, was immersed in the sea water (Cl 1.84‰, pH 8.1) containing Zn^{65}, the accumulation of it was high in gill, mantle, viscera and other soft tissues. On the hard tissue (shell), radioactivity was detected only a little, if any. About 40% of the radioactivity of clam was lost in 2 days after returning it to normal sea water.

When the carp, *Cyprinus carpio*, was cultivated in the water containing Zn^{65} 45,000 cpm/1, Zn^{65} was deposited, much in gill and kidney. It was recognized that all other tissues contained also some amount of Zn^{65}. The accumulation of Zn^{65} injected into the carp muscle was very high in kidney and followed respectively in hepatopancreas, heart, intestine, gill, scale, caudal fin, gall-bladder, skin, vertebra and muscle.

The distribution of $Sr^{90} \sim Y^{90}$ and Cs^{137} injected into the carp muscle was also studied for the comparison with that of Zn^{65}. After forty seven or forty eight hours, $Sr^{90} \sim Y^{90}$ was found to be chiefly accumulated in the hard tissues, whereas Cs^{137} was chiefly retained in the heart and kidney and was found both in the soft and hard tissues.

103. A note on the poison of a barracuda, *Sphyraena picuda Bloch* and *Schneider*. Yoshiro HASHIMOTO (Bull. Jap. Soc. Sci. Fish. **21**, 1153-1157, 1956)

A poisoning case was reported in detail, which had occurred in Tokyo in 1949 from the ingestion of barracuda fish caught at the tropical region of the Pacific Ocean. The isolation of poison from the causative materials was also attempted.

The poison was found to be soluble in methanol, ether and acetone. As a fat-soluble fish poison has not yet been found so far, this may be the first finding of the presence of it.

Young cats fed with the extracts of the fish flesh revealed symptoms similar to those observed on the poisoned animals with some narcotics, sleeping drugs or alcohol. Mice were far less sensitive than cats.

The specimens caught near at the tropic of Cancer in the Northern Pacific were also tested, and were found to be non-toxic.

104. Chemical studies on the blood hemoglobins of fishes. I. Fumio MATSUURA and Kanehisa HASHIMOTO (Bull. Jap. Soc. Sci. Fish. **21**, 1158-1162, 1956)

Oxy- and met-hemoglobin crystals were obtained from the blood of several kinds of fish, i.e., *Thunnus orientalis* (immature), *Katsuwonus vagans*, *Cyprinus carpio*, and *Seriola quinqueradiata*, etc., by Schulz's method, by Drabkin's method or by the modification of the latter, and studied spectrophotometrically. The spectra of various derivatives of these hemoglobins were then compared with those of horse hemoglobin prepared for reference, and it was found that there are neither marked specific differences between fish and horse hemoglobins as seen in the cases of myoglobins, nor among hemoglobins from several species of fishes.

105. Studies on the crystalline style of molluscs. II. Chemical constituents of the style of *Mactra sulcataria* Reeve. Part 2. Yoshiro HASHIMOTO and Tokuji SATO (Bull. Jap. Soc. Sci. Fish. **21**, 352-355, 1955)

Six neutral sugar components of the style were isolated and identified respectively.

The acid-hydrolyzates of the dried style powder were passed down the column of IR 120 and followingly IRA 400 (CO_3'' form) to remove basic and acidic substances. The neutral effluent was then condensed to a syrup and fractionated on a hydrocellulose column using *n*-butanol, half-saturated with water. Five sugar fractions, respectively corresponding to deoxyribose, L-fucose, D-xylose contaminated with acetylhexosamine, D-mannose and D-galactose, were obtained. Deoxyribose and acetylhexosamine were identified with paper chromatography and color reactions. Fucose and galactose were identified as α-methyl-phenylhydrazones, xylose as dibenzylidenedimethylacetal and mannose as phenylhydrazone.

III. Amylolytic enzyme (Part 1). Yoshiro HASHIMOTO anc Shizumasa KIJIMA (Bull. Jap. Soc. Sci. Fish. **21**, 1034-1040, 1956)

The thermostability, effects of several ions, and optimum pH were examined on the style amylase, estimating both dextrinogenic and saccharogenic activities. In these experiments, the style amylase was found to be not a single one. Styles from *Meretrix luzoria* and *Mactra veneriformis* were used. The starch-dextrinizing enzyme in the style was proved to be very labile to heat, but phosphate increased its thermostability. Even in the presence of phosphate ions, however, the enzyme was inactivated at far lower temperatures than the malt α-amylase. The most interesting and important character of the style amylase was found in its high saccharogenic activity. The ratio of saccharogenic activity to dextrinogenic activity of the style amylase was two to three itmes higher than that of the typical α-amylase, such as human salivary and human blood amylases. As no maltase was detected in the style, the cause of the high saccharogenic activity must be sought into another factor. It was assumed from the results obtained in the experiments on the inuflence of temperature and pH that the dextrinogenic and saccharogenic activities of the style are mainly associated with the two different enzymes respectively.

IV. Amylolytic enzyme (Part 2). Yoshiro HASHIMOTO and Shizumasa KIJIMA (Bull. Jap. Soc. Sci. Fish. **22**, 172-175, 1956)

To elucidate the nature of the style amylase more thoroughly, the tripartite analysis of corn starch hydrolyzate was carried out by the method of Somogyi, using baker's yeast. The same experiment with the human saliva was also provided for comparison. The mode of amylolysis by *Meretrix* style was nearly the same with that by human saliva in the extent of hydrolysis and the slow and slight formation of glucose, which denied the co-existence of amylo-(1.4)-glucosidase in styles. But the most striking difference was demonstrated in the reversal of the relation between maltose and nonfermentable reducing dextrins. Namely, the main degradation products was the detrxins in the case of style amylase, whereas it was maltose in the case of human saliva. The type of amylolysis by the style amylase was assumed to be a very specific one, which did not coincide with any one ever described.

106. B-Vitamin content in the muscle of fish. Takajiro MORI, Yoshiro HASHIMOTO and Yasushi KOMATA (Bull. Jap. Soc. Sci. Fish. **21,** 1233-1235, 1956)

Thiamine, riboflavin, niacin and vitamin B_{12} in the muscles of several species of fish were determined microbiologically.

The red muscle of fish was found to contain much thiamine, riboflavin and vitamin B_{12}, but rather less niacin than the ordinary muscle. The most marked difference between the red and ordinary muscles was observed in *Katsuwonus vagans,* in which the amounts of thiamine, riboflavin and vitamin B_{12} in the former were approximately nine, twenty and six times of those in the latter, respectively.

The rich presence of these B-vitamins in the red mucsle may support the assumption formerly proposed by several workers including the authors that the muscle takes a part of the physiological functions performed by the liver, because it is well known that the liver accumulates these vitamins in it.

Finally, from the nutritional point of view, the muscle of fish may be considered to be a fairly excellent source of B-vitamins, such as riboflavin, niacin and vitamin B_{12}.

107. Animal protein factor (APF) and vitamin B_{12} in marine products. VI. Degradation of vitamin B_{12} by vacuum-dried cells of *Escherichia coli.* Takajiro MORI and Yasuhiko MAEDA (Bull. Jap. Soc. Sci. Fish. **21,** 492-493, 1955)

To ascertain the presence of the vitamin B_{12} destroying enzymes, several experiments were carried out, using *Escherichia coli.* In these experiments vitamin B_{12} was determined by the *Euglena* method, after digesting bacterial cells with trypsin.

The extracellular enzyme was not detected, as the culture medium revealed no decomposing activity on the vitamin. The intact cell suspension, however, degraded the vitamin under the presence of bacteriostatic agents such as toluene, chloroform and thymol. The cells killed and dried by the Lyophil method were capable for the vitamin degradation, whereas the activity was lost entirely in the acetone-dried cells.

108. B-vitamins in marine products and their changes in processing and storage. I. Canned mackerel and tuna in brine. Yasushi KOMATA, Yoshiro HASHIMOTO and Takajiro MORI (Bull. Jap. Soc. Sci. Fish. **21,** 1236-1240, 1956)

The effect of canning procedure and storage on B-vitamins in mackerel and tuna was studied. They were packed in ½ lb. cans, heat-processed according to usual commercial method and stored. The vitamins were determined microbiologically.

After canning, mackerel meat retained 48, 93, 95 and 102% of thiamine, riboflavin, niacin and vitamin B_{12} present in raw meat respectively and analogous figures of tuna meat were 30, 84, 87 and 96%. In both cases, it seemed that there was no significant loss of B-vitamins in canning, except thiamine.

During 6 months storage at room temperature canned mackerel and tuna retained almost unchanged values of riboflavin, niacin and vitamin B_{12} present in the products immediately after canning, but a considerable amount of thiamine was lost perhaps owing to oxidation while in storage.

The juice which had separated from fish meat in heat-processing contained 10 to 20% of the total vitamins in a can.

109. Amino acid composition of fish muscle protein. Shoji KONOSU, Shin-ichi KATORI, Ryozo OTA, Sakanari EGUCHI and Takajiro MORI (Bull. Jap. Soc. Sci. Fish. **21**, 1163-1166, 1956)

Seventeen amino acids of muscle proteins, prepared from 10 species of fish, which are important and representative of Japanese foodstuff were determined by microbiological methods. The results obtained are tabulated.

It was expressed in the previous paper that amino acid composition of fish muscle proteins analysed were relatively uniform. The same result was obtained in this study, too, although some slight differences were observed in several amino acids, especially in aspartic acid.

Therefore, it may be possible to state that the amino acid composition of the fish muscle protein is relatively constant without distinction of species, including cuttle-fish and shark.

Furthermore, it is noteworthy from the nutritional point of view that the content of essential amino acids of cuttle-fish muscle protein is almost same as that of the fish.

110. Studies on whale oil. XII. On the lipid from *Calanus cristatus* (Part 1). Fatty acid composition of oil from *Calanus cristatus* collected in the stomach of the fin whale caught in the Northern Pacific Ocean. Masamichi SAIKI and Takajiro MORI (Bull. Jap. Soc. Sci. Fish. **21** [9], 1041-1044, 1956)

Calanus cristatus, collected in the stomach of the fin whale caught at the Northern Pacific Ocean, was extracted by alcohol, acetone and ether, and a reddish brown oil was obtained. The content of oil of the specimen was 58.63 per cent. in dry matter, and the amount of unsaponifiable matter of the oil was 43.1 per cent.

The mixed fatty acids of this lipid are composed of 16% saturated acids (myristic 9%, palmitic 7% and trace of C_{18}) and 84% unsaturated acids (C_{14} 3%, C_{16} 10%, C_{18} 14%, C_{20} 29% and C_{22} 28%). The observed existence of large amounts of unsaturated C_{20} and C_{22} acids is noteworthy.

Our results indicate that the *Calanus cristatus* which feed on diatoms and other marine phytoplankton having fat containing a relatively small amount of unsaturated C_{20} and only a little of C_{22} acids, comes to possess fat having significant amounts of unsaturated C_{20} and C_{22} acids.

VI. Forestry

Abstract Nos. 111—138

111. Decision of the number of instar and generation by means of measurements on the larval head of May-beetle. Masatoshi NITTO and Kanzi TACHIBANA (Journ. Jap. Forestry Soc. **37**, 326-333, 1955)

This is one of the reports in a series of our work concerning the ecology of two species, SHIROSUZIKOGANE (*Granida albolineata* MOTSCHULSKY) and AODOGANE (*Anomala albopilosa* HOPE.), by which pine trees planted on the sand dune of the southern coast

of Boso Peninsula for a windbreaking forest, have been injured severely.

As these trees suffered from the above two species while in their larval stage, it is fundamental to determine the number of moultings, of instar, and of generation for effective control methods.

Direct observations on these items under field conditions, difficult because the larval habitat is confined to the under ground, and the rearing of these species is also difficult under controlled conditions. The head of the insect in the larval stage is definitely chitinized in general, and is so in the two species dealt with here; furthermore, it is believed that the size of the head is almost changeless during a studium. Therefore, it may be proper to measure the head size as an indicator of these items.

The larvae were collected at three different times in 1954, and the length and breadth of parts of the head was measured with a micrometer.

The results of these measurements on a great number of larvae are as follows, and the observations on the larvae bred in the field confirmed these results.

(1) Larvae of these two species undergo two moults in the larval stage.

(2) The head breadth is most reliable as an indicator showing each instar of SHIROSUZIKOGANE and AODOGANE. In the former, the head length, frons length, and mandible length; in the latter the head length and the frons length are next to head breadth as indicator.

(3) In SHIROSUZIKOGANE the total life cycle is completed in two years, whereas in AODOGANE it is one or two years; but the number of individuals extending over the two-year period seems fewer than those of the one-year.

112. An ecological study of May-beetles on the Coastal Sand Dune. (II) (Changes of population density of larvae in relation to a lapse of time after planting.) Masatoshi NITTO and Kanji TACHIBANA (Bull. Tokyo Univ. Forests, **50**, 97-104, 1955)

In order to study the change of population density of Shirosujikogane (*Granida* albolineata MOTSCHULSKY) and Aodogane (Anomala albopilossa HOPE.) that may be assumed to take place after planting of the windbreaking forest, observations were made on the sand dune of the southern coast of Boso Peninsula in 1951–1954. The survey of population density was carried out in two different areas of the dune; one was left under natural conditions and the other covered with pines planted in different years.

In the former, the population density of the Stable zone where the movement of the sand dune had been negligible, was lower compared with that of the Semistable zone which was on the way to stop a shifting sand. The PH value, relative amount of Cl and soil moisture measured at the same time indicated that those values were much the same on the various places at different distances from the beach, excepting those on the place adjoining beach. And it was assumed that the population density was not affected by those factors.

In the latter, the density of the larvae decreased with a lapse of time after the planting. In other words, the density in 1954, at the area afforested in 1951, became remarkably lower compared with that of 2 years before at the same places, and the larvae were seldom found in the areas planted in 1950. Also at the fore and hind areas of the afforestation, changes had occurred in the vegetational cover, and the larvae inhabiting at the places adjoining the beach increased in number as the

vegetational cover advanced.

(III) (White grub damages to young plantations and the seasonal history of May-beetles.) Masatoshi NITTO and Kanji TACHIBANA (Bull. Tokyo Univ. Forests, **50**, 105-115, 1955)

In the previous papers, we reported that a distinct relation existed between the vegetational covers and the larval inhabitation of two species of May-beetle (Shirosujikogane and Aodogane).

In the present investigation, the seasonal history and habits of these beetles and their injuries to the newly established plantations are to be inquired in order to make clear the influences of various conditions affecting to the inhabitation of the larvae.

The result obtained are as follows:

(1) An occurrence of the pine injury caused by the larvae of two species of May-beetle is confined to the year pines planted, and it becomes less thereafter.

(2) The larval population showed a tendency of decrease after 1950, judging from the fluctuations in terms of the ratio of injuries.

(3) In the planting areas, scant in varieties of conditions, the distributions of larvae are found random, being deduced from the survey of injured trees.

(4) Wind direction during the flight season of these beetles and natural features of the area are closely related with the inhabitation of larvae. Many larvae are found on the slope exposed to the main wind; whereas on the opposit side, less are found.

(5) Depressions and marshes are unsuitable for inhabitation of larvae.

(6) It seems that as the beetles deposit their eggs around the areas newly planted, a large population of the larvae appear in these places accordingly.

(7) Larvae inhabited in a high level, the place short of 10 m in breadth between the second sand accumulating hedge and the front of planted areas.

(8) Both Aodogane and Shirosujikogane were attracted by a fluorescent lamp, but they were small in number.

(9) 16 species of May-beetles were attracted to a fluorescent lamp, and almost all of them came from the inland except Shirosujikogane and Aodogane.

(10) The time when beetles come flying to the lamp, varies with their species and sex. In the case of male and female of Shirosujikogane, it is respectively about 20 and past 21 o'clock. But both sexes of Aodogane come at half past 20 o'clock abundantly.

(11) The emergence of beetles starts from late June in the case of Shirosujikogane, while the middle of the same month in Aodogane, and ceases in middle september in the former, in late September in the latter. The peak of emergence takes place between early and middle August in both species.

(12) Both Shirosujikogane and Aodogane go through three instars in their larval stage.

(13) Shirosujikogane requires two years to complete its development and in the case of Aodogane one year is normal but some of them complete their life cycle in two years.

113. Influence of Wind on the Dispersion of the Chestnut Gall Wasp. Masatoshi NITTO and Kanji TACHIBANA (Bull. Gov. Forest Experiment Station **83**, 89-98, 1956)

As the extension of chestnut injuries caused by the attacking of the chestnut gall wasp seemed to be attributable to the agency of wind currents, we examined the correlation between the direction of the prevailing wind and the dispersion of the injuries in the Kanto region.

After these examinations, the influences of wind velocity on the dispersion of the wasp was studied by means of a wind tunnel in the laboratory. The results are as follows:

(1) In 1953, the area infested by the chestnut gall wasp in the Kanto region extended in all directions from that of the previous year; however, the northward advance was more remarkable. It might have resulted from the direction of the prevailing air currents from late June to early July.

(2) According to the field observation on a calm day, the wasp was scarcely able to fly for a distance of 1 *m*.

(3) The wasp shows a positive anemotaxis.

(4) In the range of wind velocity 0.15 ～ 0.45 *m/sec.*, the wind stimulates adult wasps to fly upwards, and carries them leeward.

(5) When wind exceeds 0.28 *m/sec.*, it arrests the movement of the wasp, and a wind velocity of 0.78 ～ 2.27 *m/sec.* is incapable of blowing away the wasp that clings to the substratum.

(6) When wind exceeds 3.15 *m/sec.*, it blows off almost all wasps leeward.

(7) From the results obtained by the present experiment, we are led to the conclusion that the long distance dispersal of wasps from their breeding area is brought about by their flying upwards in weak wind currents at first, and then travelling leeward influenced by stronger winds.

114. Some taxonomical notes on Thymelaeaceae found in Japan and the adjacent regions (2). Toshio HAMAYA (Journ. Jap. Bot. **30**, 328-335, 1955)

2. On *Daphne Genkwa* S. et Z.

The width of variation and distribution and the habit of *Daphne Genkwa*, a member of the sect. Genkwa are discussed with the description of a new form of it.

3. On *Diplomorpha* MEISSNER.

The independence of the genus *Diplomorpha* is asserted on the basis of (a) the position of the articulation of a pedicel and (b) the branching habit. All members of this genus found in Japan and its adjacent regions are put into three groups. Within each group, some observations and taxonomical opinions of the writer are described and discussed.

115. A dendrological monograph on the Thymelaeaceae plants of Japan. Toshio HAMAYA (Bull. Tokyo Univ. Forests, No. **50**, 45-96, 1955)

The writer continued his studies on the group of Japanese Thymelaeaceae, with special emphasis on its taxonomy. Some members of this group are important material plants for the making of the Japanese paper: "*Washi*". By studying the branching habits, the shapes of the hypogynous discs and the articulation of the pedicels within the exomorphological characteristics, and the internal phloem fibers in the shoots, the vascular bundles in the leaf axes, the spiral thickenings of the tracheary elements in

the leaves, the crystals and the sculptures of the pollen grains within the microscopic ones, he concludes the independence of the genus *Diplomorpha* MEISSNER and *Daphnimorpha* NAKAI. Moreover, he also discusses the realtionships of the five Japanese genera, viz. *Daphnimorpha, Daphne, Diplomorpha, Wikstroemia* and *Edgeworthia*, and adds the analytical keys, the descriptions and the distribution maps of the 19 Japanese species.

116. Notes on Japanese ferns (6-8). Satoru KURATA (Hokuriku Journ. Bot. **4**, 62-64, 114-115, 1955; **5**, 16-18, 1956)

Such ferns as *Athyrium deltoidofrons* form. *acutissimum* (grad. nov.), *Athyrium yokoscence* form. *dilatatum* (grad. nov.), *Coniogramme intermedia* form. *villosa* (grad. nov.), *Coniogramme intermedia* form. *Nosei* (form. nov.) and *Lepisorus clathratus* var. *Namegatae* (var. nov.) are taxonomically and plant-geographically studied. It is especially interesting that the last fern is disjunctively distributed to central Honshû far from the area of the tyipcal *Lepisorus clathratus*, Continental Asia, and restricted to the limestone cliff of Mt. Toyoguchi of Shinano Prov.

117. Comparative activities degrading cellulosic substances by wood-rotting fungi. Shun-ichi YOKOTA (Bull. Tokyo Univ. Forests **50**, 37-44, 1955)

Comparative activities of the cellulolytic enzyme produced by nineteen species of wood-rotting fungi (ten species of white and nine species of brown rot fungi) were tested by using such cellulosic substances as filter paper strips and CMC (DP, 155: DS, 0.48). These fungi were inoculated to the filter paper strips and incubated at 27°C for 3 weeks. Differences of the weight of the filter paper strips before and after incubation were measured and the rate of the weight loss was calculated. At the same time, pH of each filtrate, in which filter paper strips inoculated were placed, was measured and then, dialyzed filtrates were used as samples for the determination of C_x activity.

Percentage of the weight loss of the strip with *Trametes sanguinea* showed the greatest value of 16.6%. The great differences in the weight loss of the filter paper strips between white and brown rot fungi were the most prominent fact in the present experiment. Weight loss caused by white rot fungi were greater than those by brown rot ones except where *Tyromyces balsameus* was tested. On the contrary, C_x activities of brown rot fungi were greater than those of white rot fungi, and as such no correlation was recognized between the degradation of filter paper strips and C_x activities.

118. Freie Aminosäuren in den reifenden *Ginkgo*-Samen (Free amino acids in the ripening seeds of *Ginkgo biloba*). Ken-ichi HATANO (Jour. Jap. For. Soc. **37** [12], 527-529, 1955)

Free amino acids in the ripening seeds of *Ginkgo biloba* were analyzed qualitatively by using the two dimensional paper partition chromatography. In spring arginine was not detected in the seeds and asparagine appeared only before September. Though detailed analysis of the seeds in the state of post-ripening were not carried out, asparagine was also detected in these materials.

According to the periodical appearance of asparagine in the seeds, a correspon-

dence among the degree of ripening of the seeds, their activity, and the formation of protein was given.

119. Reconsideration of design of an open channel. Sadao OGIHARA (Misc. Infor. Tokyo Univ. Forests **11**, 15-25, 1956)

Further studies have been made relating to the discussion in Bull. Tokyo Univ. Forests No. 43, 1952. The present paper discusses the terms, water velocity V, gravel diameter b and stream gradient I, involved in the equations for designing an adequate open channel. It now appears that there is a definite relation between I and the hydraulic mean depth R derived from the channel cross-section. When either R or I is known, then the other can be determined directly. Thus, the channel design procedure is simplified.

120. Notes on erosion and its counter-measures. Sadao OGIHARA (Misc. Infor. Tokyo Univ. Forests **11**, 27-37, 1956)

Some important problems are discussed and the writer's idea for their counter-measures are expressed. The content consists of the following items; Nature and Erosion Control, Does a Forest Give Unfavorable Influences? Erosion Control as a Counter-measure for Timber Shortage. Some Notes on High Dams, Idea of the Dam Plain, Forestry and Stream Works Should Go Together to Control Flood, The Budget Should Be Elastic for Erosion Control.

121. Lumbering (Wood-felling and log-making) by the one-man type chain saw. Makoto FUJIBAYASCHI (Trans. 64th Meeting, Jap. Forestry Soc. 275-277, 1955)

During several years, it has been a problem whether or not the use of Chain-saw is useful in the mountain forest logging operation of our country. In order to solve such a problem some model operation tests were carried out in the Amagi National Forest in Shizuoka prefecture. The results of them are as follows.

I. Specifications of Chain saws

Name of machine	Partner	Mall (OMG)	McCulloch (3-25)	Be-Bo
Make	Sweden	U.S.A.	U.S.A.	Sweden
Length of saw blade	18″	24″	18″	18″
Total weight	31.35 Lb	36.08 Lb	31.79 Lb	36.70 Lb
Engine	2-cycle air-cooling gasoline engine 4.5HP/4000 r.p.m.	2-cycle air-cooling gasoline engine 3.5HP/5000 r.p.m.	2-cycle air-cooling gasoline engine 3.0HP/4500 r.p.m.	2-cycle air-cooling gasoline engine 4.5HP/4000 r.p.m.
Ratio of gasoline to mobil oil	15:1	20:1	16:1	14:1
Carburator	diaphragm type	diaphragm type	diaphragm type	float type
Apparatus of chain oil supply	automatic type	automatic type	hand operation type	hand operation type

II. Date and place of the test

(A) From October 1st to December 14th (1953) at 102 Compartment of Takata Working Unit.
(B) From January 1st to 31st (1955) at 199 Comparment of Takata Working Unit.

III. Species and age of wood

Sugi (*Chryptomeria Japonica* D. DON)
60 years (artificial plantation)

IV. Efficiency of work

(A)

Number of trees	Number of logs	Volume of logs
2,052	7,616	3,383.98 koku

(1 koku=0.287 m^2)

Condition*	a	b	c	Mean
Efficiency (koku/man-day)	14.54	7.27	11.6	12.33
Efficiency ratio of chain saw to hand work	1.32:1	0.63:1	1.0:1	1.13:1

*Condition a: inclination of land less than 40° or volume of a tree more than 1 koku
,, b: inclination of land more than 40° or volume of a tree less than 1 koku
,, c: hand work in the past at neighbour place.

(B)

Chain-saw	Inclination of land	Efficiency	
		koku/man-day	Ratio of chain saw to hand work
Partner	35° 25°	3.66 3.34	about 1.3:1
Mall (O.M.G.)	23° 35°	3.41 3.98	

So as to know how the efficiency of work will be effected by these conditions, I made a study of the double correlation among efficiency of work Y, volume of a tree X_1, inclination of land X_2 and obtained the following formula:

$$Y=14.24+3.1\,X_1-0.20\,X_2$$

As the result of it, it may be numerically concluded that the efficiency of work is more influenced by volume of a tree than by inclination of land.

V. The outline of total expense of lumbering is as follows.

Condition	a	b	c	total mean
Expense (yen/koku)	55.946	83.620	57.820	60.910
Ration of chain saw to hand work	0.97:1	1.45:1	1.0:1	1.04:1

VI. Fatigue of workers

In the case of using Chain saw it is often said that the fatigue of workers may be increased because of the weight of Chain saw. But the results were contrary. The total energy consumpting at the standard daily work which based on the *Relative Metabolic Rate* and the *Motion Time Study* was about a half of hand work in the case of Chain saw work.

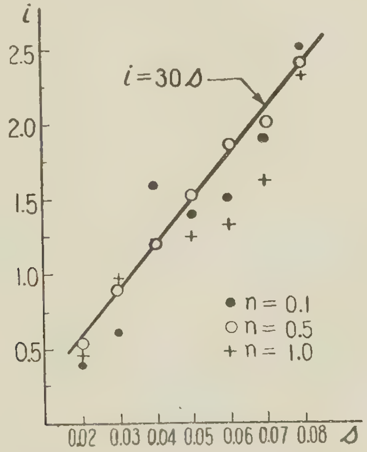
As the conclusion derived from the above investigations, I got a forecast that the Chain saw work would be more effective and useful in any mountain forest in our country.

122. Bush-cleaner. Makoto FUJIBAYASHI (Forestry Technique **2**, 5-10, 1955)

For the purpose of bush cleaning, the author invented a machine which was called, "Bush-cleaner." Similar machines of foreign make were not always useful for the Japanese workers chiefly because of its heavy weight and high price. So the author invented one suitable for them and carried out some operation tests. The results showed superiority of this home-made machine and it will be widely used here in future.

123. On the impact coefficient of the carriage load at the logging cables. Seihe KATO (Trans. 64th Meeting, Jap. Forestry Soc. 287, 1955)

Among the dynamical factors which has influence on the tension of main cable, running resistance and centrifugal force are comparatively little, but the impact factor is fairly great. So in order to plan and inspect cable installations it is



necessary to consider the impact influence. The author took into account the impact load of carriage and treated its coefficient as a similar concept in the case of bridges.

If we denote the carriage load P and impact coefficient i, the total load is given by $P(1+i)$.

In order to measure i the author carried out a model experiment by means of ideal *Suddenly Applied Load.*

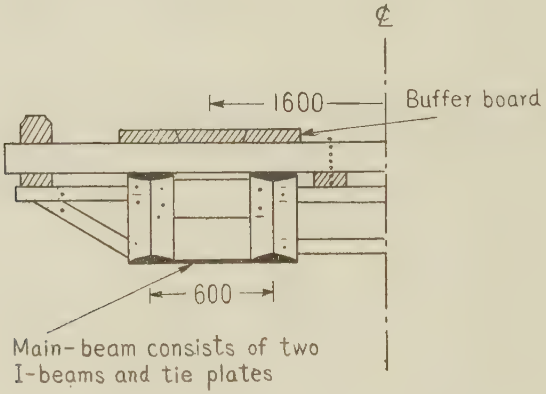
As the results, the coefficient i is related to the sag-ratio of the cable s linearly, but to the load-ratio n regardlessly. So i is give by the following formula:

$$i=a \cdot s$$

The numerical value of a is nearly 30 (See figure), but actually on the logging cables, the value of a may be approximately one-fifth of it, i.e. $i=6\ s$.

124. An idea of semi-permanent I-beam bridge for forest road. Seihei KATO and Masakazu MARUYAMA (Trans. 64th Meeting, Jap. Forest Soc. 293, 1955)

The wooden bridges decay several years after its construction. It is hoped to change these wooden bridges into permanent ones. In the case of forest road some types of semi-permanent bridges will be effective from the view point of economy. Here the authors suggest an idea of such a semi-permanent bridge, where only main stressed beams are made of steel and other parts of the structures are wooden, as shown in the following figure and table.



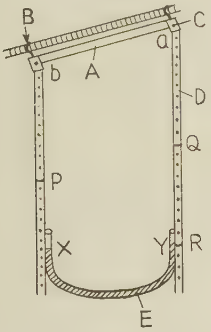
Length of bridge (m)	Effective span length (m)	Dimension of I-beam (mm)
5～ 6	5.5	350×150× 9
6～ 8	7.5	400×150×10
8～10	9.5	450×175×13
10～12	11.5	600×190×13 (600×190×16)

125. On the apparatus for measuring inclination of the skyline logging cables. Seihei KATO and Shoji OKAWARA (Trans. 64th Meeting, Jap. Forestry, Soc. 285-287, 1955)

The measurement of the inclination of the skyline logging cable is often taken into practice in the case of determing the maximum tension and the safety factor of an aerial cable way or a skidding cable. Nevertheless accurate measuring is difficult enough in field work. Even if we measure the inclination elaborately by means of hand level or inclination meter, as in the past, accurate results cannot always expect, because the height at the supporting point of the cable is more than few meters from the ground.

So the authors invented a simple, portable, and accurate apparatus for this purpose.

The structure of it is as follows:



A: A bar (from *a* to *b* is just one meter in length)
B: Hooks (which could be hung on any cable)
C: Hinge
D: Jointable pipe, which is graduated from the hinge (P, Q, R, are jointing points)
E: Vinyl pipe filled with water

When one intend to measure inclination of the cable, join the vertical poles according to the height of the cable and hang it on the cable. And then hold the vinyl pipe with both hands. If he reads the right and left graduated arms *Y* and *X* respectively by metre unit, Y-X means sinθ.

Owing to the acute water levelling, he can apprehend the inclination of the cable with sufficient accuracy.

126. Discussion of the flexural rigidity of Howe-type wooden deck trusses based on the vertically forced vibration. Masakazu MARUYAMA (Journ. Jap. Forestry Soc. **37,** 337-341, 1955)

Vibration tests applied to ascertain the flexural rigidity of Howe-type wooden deck-trusses in two kinds of forest-railway bridges, one of which was relatively new (constructed 1½ years ago) and the other comparatively old (in use for 11 years).

The truss was vertically vibrated by means of a rotary eccentric mass vibrator operated by hand. The resonance of the fundamental vibration of the truss to this damping forced vibration was recorded on a displacement vibrograph. The measured value (T) of the natural period of vibration of each truss was compared with the ideal theoretical period (T_0) of the same truss. The rate (ϕ) of decrease in the flexural rigidity of each truss was calculated by the following formula:

$$\phi=\frac{T^2-T_0^2}{T^2}\times 100\%$$

It was found that the values of ϕ showed 30 ~35% in the case of the older bridge, on which locomotive traffic was prohibited because of danger, while in the case of the new bridge, ϕ showed a slight difference from the theoretical value. Moreover, the value of ϕ indicated the looseness of the bolts and nuts in the vertical members and whatever slight irregularity existed in the structure. Thus, the vibration test showed the practical possibility of some exact and quantitative judgement of the flexural rigidity, and finding of the structural defects of a bridge.

127. On the boring-test of wooden bridge members for their durability judgement. Shoji OKAWARA (Trans. 64th Meeting, Jap. Soc. 289-291, 1955)

Basing the study on the consideration that the unique boring-test method might be more effective for practical purposes to investigate the durability of wooden members of the forest road bridges, the author carried out fundamental experiments about Tsuga wood (*Tsuga Sieboldii* CARR.) which is one of the most widely used wood species for bridges in our country.

According to the experiments which were formerly carried out by KATO and KAMIIZAKA, the boring test had a foresight to be effective for practical purpose to judge durability of wooden structural members.

This method is recognized more effective regard to its normal and artificially decayed wood. In this sense the author performed following experiment.

(1) Preparing the test piece (3×3×6 cm) from normal and every naturally decayed members which were abolished in old days.

(2) Classifying them into two groups: one is in air dry condition, the other is over fibre saturation point.

(3) Application of both the boring and compression test to each group.

As a result of the experiment mensioned above, it was recognized that there is almost a linear relation between boring energy and compressive stress and each group is almost adjacently parallel to each other.

The author concluded that according to the boring-test alone, we can presume the durability or decayed degree of the members regardless of moisture content, and so this method will be very effective to the actual durability test in the field.

128. Drought resistance of some conifers at the first summer after their emergence. Taisitiroo SATOO (Bull. Tokyo. Univ. Forests **51**, 1-108, 1956)

Drought resistance at the first summer after emergence from seeds of *Cryptomeria japonica, Chamaecyparis obtusa,* and *Pinus densiflora,* the most important forest tree species in Japan, was compared and the factors determining the differences among them was analyzed.

The following investigations were carried out; effect of soil moisture deficiency on the growth of the seedlings, development of root system in relation to the degree of drought resistance, determination of the degree of dehydration of the seedlings at their lethal levels, relation between dehydration of sedlings and recovery of water content when rehydrated, changes in transpiration rate and water content of the seedlings with decreasing soil moisture, changes in transpiration and water content of the seedlings after stopping water supply. The most important factors determining the drought resistance of the three species are the magnitude of cuticular transpiration and the development of root systems.

129. The influence of wind on transpiration of some conifers. Taisitiroo SATOO (Bull. Tokyo Univ. Forests **50**, 27-36, 1955)

The influence of wind on transpiration was compared among three species; *Cryptomeria japonica*, *Chamaecyparis obtusa*, and *Pinus densiflora*. The acceleration of transpiration by wind was highest in *P. densiflora* and lowest in *Ch. obtusa*, regardless of the duration of the exposure to the wind. However, the influence of wind on transpiration became less prominent as the duration became longer. Just after the beginning of exposure to wind, rate of transpiration increased suddenly and then decreased gradually until it shows a lower value than in the quiet air, and the difference in the acceleration of transpiration among the species became insignificant. The rate of decrease in transpiration with the lapse of time of exposure to wind was highest in *P. densiflora*.

Transpiration increased with increasing wind velocity, but the increase was not proportional to the wind velocity, and it slowed down over a certain limit, which was about 0.3–0.6 m/sec. The limit was rather clear for *P. densiflora* and *Ch. obtusa*, but it was vague for *Cr. japonica*. Above these limit, the increase of transpiration with increasing wind velocity was higher in *Cr. japonica* than in *P. densiflora* and *Ch. obtusa*.

130. The influence of wind on dry matter increase in leaves of *Quercus acutissima*. Taisitiroo SATOO (Bull. Tokyo Univ. Forests **50**, 21-26, 1955)

Dry matter increase per unit area of leaves of *Quercus acutissima* during daytime was hindered by exposure to artificial wind. The effect of wind became more intense when soil moisture was more deficient, or when the duration of exposure to wind was longer. Even after the wind ceased, the effect remained. The aperture of stomata was affected by wind in the same way as dry matter increase, though to a lesser degree.

131. Vertical distribution of roots of *Pinus Thunbergii* invaded in denuded area. Taisitiroo SATOO and Yoshio WAKABAYASI (Journ. Jap. Forest. Soc. **37**, 407-408, 1955)

Vertical distribution of roots of *Pinus Thunbergii* was compared between those invaded in a denuded area and those planted on such an area after hill-side works. Most roots distributed in the upper layers of the soil on both sites, but this trend was more vivid in those in the denuded area. This trend is supposed to be related partly to the physical properties of the soils. Among those invaded in the denuded area, no relation was recognized between the amount of roots and the size of the parts
one.
above the ground, an extremely stunted tree had more roots than a rather thrifted

132. Origin and development of adventitious roots in layered branches of 4 species of conifers. Seizaemon SATOO (Journ. Jap. Forest. Soc. **37**, 314-316, 1955)

Origin and development of adventitious roots were observed in layered branches of 4 species of conifers. In *Cryptomeria japonica* and in most cases of *Thujopsis dolabrata*, adventitious roots developed from the phloem region in connection with multiseriate rays in the former and biseriate rays in the latter, but in some *Thujopsis*, adventitious roots arose in connection with ordinary uniseriate rays. On the other

hand, the roots in *Pinus pumila* and *Sciadopitys verticillata* arose from the phloem region in connection with lateral branch traces.

133. Anatomical studies on the rooting of cuttings in coniferous species. Seizaemon SATOO (Bull. Tokyo Univ. Forests **51,** 109-158, 42 plates 1956)

The number of genus studied in this work counted 23 and they covered 31 species of coniferous as follows; *Cryptomeria japonica, Thujopsis dolabrata, Chamaecyparis obtusa, Chamaecyparis pisifera, Ginkgo biloba, Cephalotaxus drupacea, Podocarpus macrophyllus, Taxus cuspidata, Torreya nucifera, Pinus densiflora, Pinus Thunbergii, Pinus silvestris, Pinus pinaster, Pinus strobus, Sciadopitys verticillata, Larix Kaempferi, Abies firma, Abies Mayriana, Tsuga Sieboldii, Picea excelsa, Thuja Standishii, Thuja occidentalis, Cunninghamia lanceolata, Juniperus rigida, Cedrus Libani var. Deodara, Cupressus Lawsoniana, Sequoia sempervirens, Sequoia gigantea, Taxodium distichum, Taiwania cryptomerioides,* and *Metasequoia glyptostroboides.*

Adventitious roots in these coniferous cuttings developed from the five following tissues near the cut bases: 1) cambial and phloem portions of ray tissues, 2) leaf and branch traces, 3) bud meristem and bud traces, 4) irregularly arranged parenchymatous tissues, and 5) callus tissues. A classification of them by species and tissues was made.

134. Some experiments on vegetative propagation of *Paulownia tomentosa* and anatomical observation on the origin and development of adventitious shoots androots. Seizaemon SATOO and Masao FUKUHARA (Journ. Jap. Forest. Soc. **37,** 317-320, 1955)

A certain number of adventitious shoots were obtained from root pieces of *Paulownia tomentosa* placed in moist moss in a greenhouse and in soil in a nursery. Of the cuttings taken from these adventitious shoots, about 25% of them rooted and about 50% of them died. Adventitious shoots originated in newly formed meristematic tissues between the inner cortex and phloem near the old lateral root traces, and developed to typical bud primordia. Adventitious roots from original root pieces developed from the cambium and phloem region in connection with lateral root and ray tissues of original root pieces. Adventitious roots from cuttings of adventitious shoots developed from the phloem and inner cortex region and some of them developed in connection with newly formed irregularly arranged xylem at the cut base. Adventitious roots from adventitious shoots connected with original root pieces arose from the cambium and phloem region, connecting the ray tissues.

135. Photosynthesis, respiration and consumption of reserves of Sugi (*Cryptomeria japonica*) cuttings. Ken-itiroo NEGISI and Taisitiroo SATOO (Journ. Jap. Forest. Soc. **38,** 63-70, 1956)

This paper is a record of observations on apparent photosynthesis and respiration of Sugi cuttings in relation to consumption of carbohydrate reserves that happened during a period extending from planting to rooting of them.

The amount of carbohydrate consumed directly, for rooting of cuttings, was not so much as to lower the level of it, and this consumption was compensated to some extent by photosynthesis of cuttings performed after planting.

136. A physiological study of germination of coniferous seed by the application of water absorption curve. Masasi GOO (Bull. Tokyo Univ. Forests **51,** 159-236, 1956)

The author studied about water absorption of coniferous seeds for many years. From these results, it was found that the water absorption curves indicate the activity in each stage of the seed, from the dormant to germination. In this research I have taken up this water absorption method as the tool for it. The investigations were carried out as follows:

I. Absorption of water by coniferous seed.

II. Water absorption in relation to environmental factors and to internal changes of seed.

A. Water absorption and desiccation.

B. Temperature and water absorption.

C. Autumn seeding, spring seeding and seeding of seed-with-cut-radicle.

D. Water absorption and oxygen consumption.

E. Water absorption and light.

F. Water absorption and changes in the seed.

From these resutls we have had many new knowledge to the germination of coniferous seeds.

137. Changes in the stored food within the seeds of *Pinus densiflora* and *P. Thumbergii* during the course of germination—by microchemical tests—. Masasi GOO and Kenzi FURUSAWA (Journ. Jap. Forestry Soc. **37,** 481-484, 1955)

Samples were taken at five different stages in germination. Namely: I. dry seed; II. and III. two and four days after set on seed bed, respectively; IV. appearance of the crack; and V. appearance of the radicle.

Because the seeds of *P. densiflora* showed a very poor per cent germination, part of them were exposed to a low temperature of 5°C for two weeks.

1. pH. Changes of the pH values for the endosperm and different parts of the embryo was small. But in the low temperature, value of $H^{\cdot}$ ion concentration the endosperm and the root cap went down.

2. Starch. Starch was found in the endosperm in the stages throughout from I to IV, but in stage V it disappeared. On the other hand, occurrence of starch in the embryo was very light in stage I, but it became frequent in the root cap with the progress of germination. In stage V, cells with a special form came into existence in the embryo of *P. densiflora*, but it was not observed in *P. Thunbergii.*

3. Reducing sugar. In the endosperm reducing sugar came out around the embryo, and in the embryo it emerged in stages I and II. However, in the root cap it decreased with the progress of germination.

4. Non-reducing sugar. In the endosperm non-reducing sugar rose in all places, and its behavior was similar to that in reducing sugar in the embryo.

5. Fat. Changes of it during the germination was small.

6. Protein. Protein in the endosperm did not change throughout stages I to V. The changes in the embryo on the dry seed were few, but increased in root initial, hypocotyl and cotyledon with the progress of the later stages.

138. Height estimation through BITTERLICH's method—vertical angle count sampling. Taneo HIRATA (Journ. Jap. Forestry Soc. **37**, 479-480, 1955)

This is theoretically the same method as that carried out in 1948 by WALTER BITTERLICH crystalized on the estimation of basal area per hectare, where he supposed each basal area enlarged with a constant ratio, for the purpose of counting the number of points included within the enlarged circles, that is to be hereafter reduced to the real basal area. Now the author supposes horizontal circles, the centres of which lie at the toes of trees and their radii equal to their heights reduced with constant ratio, for example, $1/\sqrt{\pi}$ or $1/\sqrt{2\pi}$.

The total area of these circles supposed can be briefly estimated through the same method as when the enlarged basal area, by vertical angle count sampling, instead of horizontal, apparently different from but essentially the same with BITTERLICH's method. Secondly the stem-number per hectare needs to be estimated by some proper means. With constant ratio of $1/\sqrt{\pi}$ or $1/\sqrt{2\pi}$, the estimating formula of mean height can be derived as follows to the simplest form:

$$h=100\sqrt{z/N} \quad \text{or} \quad a\sqrt{z}, \text{ and}$$

$$h=100\sqrt{2z/N} \quad \text{or} \quad a\sqrt{2z} \text{ (unit: m.).}$$

where z: the expectation of the number of the trees, the tops of which can be inspected over the critical elevation (=60°34′ or 68°15′) at a sample point within a stand.

N: stem number per hectare estimated or known.

a: root of average space estimated (m.).

When the angle of inclination between a sample point and the toe of a tree is θ, the vertical angle B must be corrected to B′ corresponding to angle θ. The automatic instrument of tangent style or such a optical form varying B to B′ can be also designed for our field work in mountain forests, and it is to be reported with results obtained later; $\tan B' = \tan B \pm \tan \theta$.

VII. Forest Products

Abstract Nos. 139—156

139. Studies on laminated woods with sawn boards. IV. On the strength of glued end joints within laminations in laminated columns of *Cryptomeria japonica* D. DON. Hisashi FUKUI, Shinji Hirai and Yôji KIKATA (Journ. Japan Wood Research Soc. **2,** 108-113, 1956)

This report presents the results of tests in which laminated columns with scarf end joints in laminations are compared to matched control columns having continued laminations only, and to those of solid timber (pith bearing).

Four types of disposition of scarf-joints as shown in Fig. 1 were designed, and two columns for each type, two control laminated ones having no end joint and four

control solid ones were tested.

All 14 columns were 180 cm long and 8.4 by 10 cm in cross section (Fig. 1).

Some strength properties of the material (*Cryptomeria japonica* D. DON from Akita Prefecture) are as follows:

specific gravity (air dry)	0.33	(0.33 & 0.42 for control solid columns)
compressive strength	264 kg/cm^2	(264 & 329 kg/cm^2 for ")
bending strength	514 kg/cm^2	(514 & 635 kg/cm^2 for ")
modulus of elasticity in bending	65,000 kg/cm^2	(65,000 & 54,000 kg/cm^2 for ")

A room-temperature-setting urea resin adhesive, containing filler (wood flour), 5% to resin, was used and glue spread of 330 g/m^2 and assembling pressure of 5 kg/cm^2 was applied for laminating. All end joints were glued with the same adhesive in a separate operation, prior to the final surfacing of laminations.

Specimens were tested with a 30 ton Amsler-type machine using knife edges at both ends, and thus the bending direction was confined perpendicular to glue lines. An axial centric load was applied and the deflection of the specimen at the midlength and the decrease of ditsance between both edges were measured at intervals of 0.5 ton.

Table 1. Buckling stresses, a and e.

Kind of column	Specimen	Maximum (Buckling) load kg	Area of cross section cm^2	Buckling stress kg/cm^2	Initial deflection, a mm	Equivalent* eccentricity of load, e mm
Control solid column	0—1	9,350	83.0	113	1.3	0.39
	0—2	9,500	83.2	114	0	4.03
	0—3	9,950	82.2	121	1.3	−0.69
	0—4	11,700	83.0	141	1.3	0.43
	Mean	10,125	—	122	—	—
Control laminated column (no end joint)	I—1	7,600	82.3	92	4.8	4.36
	I—2	11,950	81.5	147	1.8	2.57
Laminated column with scarf end joints	II—1	9,750	81.5	120	3.0	1.81
	II′—1	12,200	82.2	148	0	1.37
	II′—2	12,250	84.2	146	1.5	1.81
	Mean	12,225	—	147	—	—
	III—1	12,450	83.3	150	2.5	2.94
	III—2	12,700	83.2	153	0	2.98
	Mean	12,575	—	152	—	—
	IV—1	11,950	82.3	145	2.0	−1.10
	IV—2	9,200	82.2	112	0	3.93
	Mean	10,575	—	129	—	—

*Calculated from $\frac{\delta}{p} \cdot \frac{\pi^2 EI}{l^2} - \delta = a + \frac{4}{\pi} \cdot e$; δ: deflection, p: load, l: distance between both knife edges.

The maximum loads (buckling loads) and buckling stresses of all tested columns are shown in Table 1. The values of buckling loads or stresses for scarf-jointed specimens indicate that, with the exception of I—1 column having extreme initial deflection (a), there is no deficiency in strength as compared to control columns which have continuous laminations or to solid columns. The destruction of scarf-joints did not appear throughout the test.

The rupture by compressive shear at the maximum load appeared, except for two columns, II′—1 and IV—1, in the midlength of the compression side. In these two columns it appeared at one of the scarf-joints. In spite of this fact, the values of buckling load for these two columns are not inferior to the others.

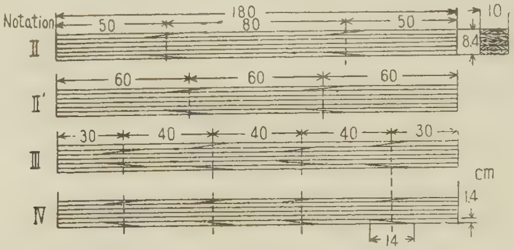


Fig. 1. Disposition of scarf-joints tested.

140. On the relation of hot-press conditions and physical and mechanical properties of chip-board. Kakuichi KITAHARA (Journ. Jap. Wood Research Soc. **1**, 17-20, 1955)

The raw material, as species used were EZOMATSU (*Picea jenoensis* CARR). and TODOMATSU (*Abies sachalinensis* FR. SCH.). The ratio of them was 1: 1. The chip was shaved by Grupp shaving machine and the binder was urea-resin and its hardner, the resin content was 11% of the oven-dried weight of the chips. The moisture content before pressing was 19%. The pressure was increased until the distant piece (stopper) touched the upper hot plate, and at that time it was about 15 kg/cm^2. After keeping it there for five minutes it decreased to 5 (kg/cm^2).

In the pressing temperature experiment, temperatures were 100, 140, 180 and 220°C, with the cycle time kept constant at 15 minutes. In the press cycle time experiment, times were 5, 10, 20 and 30 minutes, with the temperature kept constant at 140°C. Then, in the next case the times were 5, 10 and 15 minutes, with the temperature kept at 180°C. In the first of these—the 5 minutes duration—the chip board was not prepared completely and separation appeared in the middle layer of it.

Results obtained after one week were as follows:

(1) The thickness is bigger by spring back than that of the distant piece when the cycle time is very short. But it is smaller by compression shrinkage, in the contrary case.

(2) The specific gravity decreases as a result of the decomposition of chip, when the temperature is too high and cycle time is too short or too long.

(3) The moisture content decreases sharply by temperature or cycle time.

(4) The surface of the board takes on fragility at higher temperature. And this temperature will be lower when the surface raw material is a coniferous tree.

(5) Mechanical properties decrease at high temperature and long cycle time.

141. On the pressing of chip-board by hot-press. Kakuichi KITAHARA (Bull. Tokyo Univ. Forests **50**, 127-135, 1955)

The internal temperature of every layer of the chip-board in hot-press is one of the most important factors affecting the physical and mechanical properties of the board. The chips will be much more deformed with higher temperature when they are compressed by the same pressure. And the temperature of the surface layer should be raised up quickly and that of the center layer slowly to make the surface layer strong. The latter, however, should have the temperature which is necessary for polymerization of the binder, in cycle time. The author carried out several experiments to study on these points.

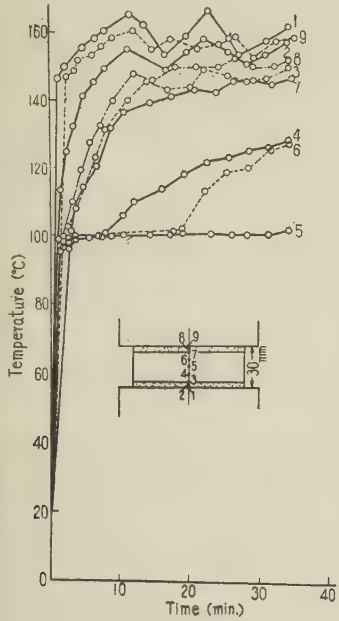


Fig. 1. The relation of temperature and time. Thickness 30mm, Specific gravity 0.65.

Results obtained were as follows:

(1) The internal temperature of every layer rises up as shown in Fig. 1. But the difference of it in outer and center layer is larger at smaller specific gravity and is smaller at large specific gravity.

(2) The physical and mechanical properties in every layer change as shown in table.

S.G. of board	Position in thickness (mm)	S.G. in air dry	S.G. in oven dry	Moisture content (%)	Brinell hardness (kg/mm²)	Tensile strength to surface (kg/cm²)
	Surface	0.56	0.52	9	—	—
	3	0.56	0.50	11	1.8	0.7
0.49	5	—	—	—	—	0.5
	10	0.46	0.41	13	0.8	0.2
	20	0.44	0.39	12	0.6	0.2
	Surface	0.74	0.68	9	—	—
	3	0.75	0.67	11	3.0	1.8
0.60	5	—	—	—	—	1.7
	10	0.58	0.52	11	1.9	0.7
	20	0.56	0.50	12	1.2	0.6

142. Effects of raw chip dimension on the physical and mechanical properties of chip-board. Kakuichi KITAHARA and Kazuo KASAGI (Wood Isdustry **10**, 406-412, 1955)

When the dimension of the raw chip is changed, the physical and mechanical properties of the chip-board are changed with it. In this case, binding material per unit surface of chip is changed if the binding material(%) is constant to the weight of whole raw chips in oven dry. And the factors affecting on them should be two, in constant pressure. One is the quantity of the binding material per unit surface of chip and the other is the dimension of the chip itself. So the author made an experiment on it, keeping the binding material per unit surface of chip constant and changing the dimension of chip in similar shape as shown in Table 1.

Table 1. Properties of chips

Mark of chips	A	B	C	D
Thickness (mm)	3.0	1.0	0.5	0.33
Width (mm)	9.0	3.0	1.5	1.0
Length (mm)	45.0	15.0	7.5	5.0
Similar ratio	18	6	3	2
Surface/Volume	1	3	6	9
Urea resin (%)	1.7	5	10	15
Total weight (g)	900	900	900	900

The obtained results are as follows:

(1) The surface and the end surface are coarse when the chip has large similar ratio.

(2) The moisture contents of boards are almost same in a week after pressing, but the pressing time was very long (30 min.).

(3) Thickness in hot-press reaches to the same value, but spring back is larger at large similar ratio, and the specific gravity of board is smaller at it.

(4) The relations of water absorption and swelling in thickness (y%) and similar ratio (x) are shown in by the formulae: $y=14+2.5x$ and $y=1.4+3.2x$. But the relations of moisture absorption and swelling in thickness (%) and simiarl ratio are almost same in all cases.

(5) The relations of mechanical properties (y) and similar ratio (x) are down by the formulae: Young's modulus; $y=3.9\,x$ (1010^{-3} kg/cm^2), modulus of rupture; $y=330\,x$ (kg/cm^2), compressive strength; $y=260\times1.32$ (kg/cm^2), tensile strength; $y=80\times0.81\,x$ (kg/cm^2), absorbed energy in impact bending; $y=6.12-0.269\,x$ (kg-cm/cm^2).

(6) Brinell hardness has no significant difference on the plane surface, but has on the end surface.

143. The influence of Temperature on Compressive Properties of Woods. Kakuichi Kitahara and Akira SUEMATSU (Journ. Jap. Wood Research Soc. **2**, 47-51, 1955)

The species tested were SUGI (*Cryptomeria japonica* D. DON), HINOKI (*Chamaecyparis obutusa* SIER. et ZUCC.), BUNA (*Fagus crenata* BL.), and LAUAN (*red lauan*).

In compression parallel to grain, compressive strength was determined at temperatures of 50, 40, 30, 20, & 10°C. In compression perpendicular to grain, proportional limit and Young's modulus were determined at temperatures of 50, 30, & 10°C. The test specimens were preliminarily dipped in dissolved paraffin to make a film on the surface of them. They were then placed in thermostat and permitted to reach an expected temperature without changing the moisture content. During the test the specimens were placed in a small box. The temperature in the box was controled by sending in hot air.

The results were as follows:

1. In all cases, compressive strength parallel to grain decreased almost linearly with the increase of temperature. The percentage of decrease per 1°C increase was 0.34 ∼ 0.92.

2. Stress at proportional limit and Young's modulus perpendicular to grain decreased with the increase of temperature in all cases.

3. In the rate of the influence of temperature, there was no significant difference between air-dry and oven-dry wood.

144. The effect of the heat treatment on fiberboard. Kakuichi KITAHARA and Yoshihiko FUKUHARA (Journ. Jap. Forestry Soc. **38**, 187-191, 1956)

In this experiment, through the measurement of mechanical properties we have attempted to know effects of treating temperature and moisture content of board on the thermo-chemical change in heating process.

As the test boards, we used three kinds of fiberboard (A. B and C), which were prepared by different processes in pulping, treated with conditions varying the above two factors and tested both impact and static bending of these specimens.

We cannot find the clear tendencies because of the sectional differences of mechanical strength of each test piece, which seem to occur in producing process of boards, but following results were obtained;

(1) With increase of treating temperature, the absorbed energy in impact bending decreases.

(2) At 200°C each strength decreases.

(3) YOUNG's modulus of bending and modulus of rupture in bending indicates the highest value at 175°C, but in "C" such tendencies isn't presented.

(4) The higher the moisture content of board before heat treatment, the more YOUNG's modulus of bending and modulus of rupture in bending tend to decrease. But only the absorbed energy of impact bending does not decrease.

145. Shrinkage of wood in kiln drying. Yasushi SUZUKI (Journ. Japan Wood Research Soc. **2**, 43-48, 1956)

The effect of the drying condition on the apparent shrinkage after drying of 28 mm beech board (*Fagus crenata* BL.) was studied. As the moisture gradient in the thickness direction of the board is nearly proportional to the drying rate in a series test of the same temperature, the magnitude of drying stress caused by moisture gradient can be relatively indicated, using the value of of the drying rate. Therefore, the set after drying (difference of shrinkage between the test specimen and set-free thin section) are plotted as a function of the drying rate (Figure 1). Positive set

means over-shrinkage of heat-dried specimen. The quantities of compression set in width direction, i.e. tangential direction in these tests, decrease with the rate of drying, and that in thickness direction, on the contrary, increase with it. The effects of air-seasoning before heat-drying upon the set were also studied and the results are shown in figure 2. In most of the runs of drying test, compression set due to collapse which generally advances at higher moisture content was not found.

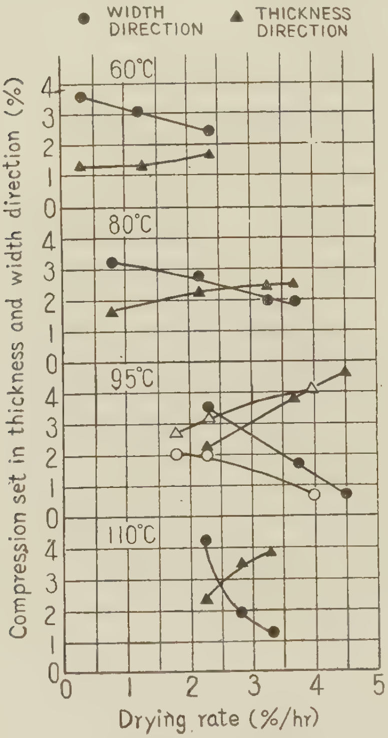


Fig. 1. Effect of drying rate on compression set in dried specimens.

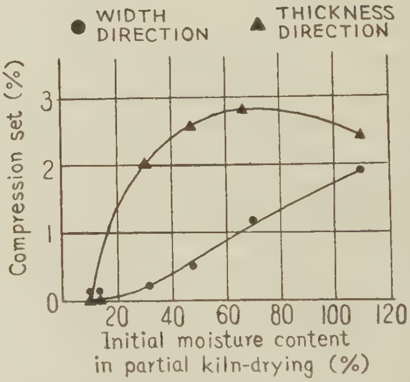


Fig. 2. Relation between initial moisture content and compression set after 80°C drying.

146. Studies on bamboo. (XI) Shrinkage of bamboo in heat drying. Yasushi SUZUKI and Yôji KIKATA (Bull. Tokyo Univ. Forests **50,** 117-125, 1955)

On the experimental studies made on the drying of bamboo (*Phyllostachys pubescens* MAGEL), the following remarks are concluded.

1. Bamboo consists of parenchymatous tissue and fibrous vascular bundles, and the physical properties change from the cuticular side to the inner part. As a result of water saturation in the cell cavities, bamboo is apt to collapse by liquid tension during drying. The outer part shrinks, mostly due to the shrinkage of clouded fibers, while the inner part does mostly due to the collapse of parenchymatous cells. The collapse increases towards the inner part, and has a peak at the considerably inner part. At the inner-most part, the collapse is not so considerable.

2. Collapse in the thickness direction is larger than that in the width direction, and the collapse on slow drying is larger than that on rapid drying at the same temperature. The collapse appears even on air seasoning.

3. From the above reasons, at the condition A (100°C rapid drying), E (air seasoning), the shrinkage in the width direction decreases towards the inner part, while the thickness shrinkage increases. At the condition B (100°C slow drying), the collapse is much larger than that by other conditions. At the B condition width shrinkage increases towards the inner part slightly and the thickness shrinkage increases more apparently.

4. In A and E conditions, the test pieces (90×25×2.5 mm) cup to cuticular side (+), and the curvature decreases towards the inner. But in B condition, the pieces cut from cuticular side, cup to the innerside (−), and the curvature decreases towards the inner, except the inner-most part, the curvature of which has a positive value.

5. With pretreating (cooking 10 min. or steaming 25 min.) and drying at A, shrinkage or cupping of the pieces does not differ from untreated pieces.

6. Reconditioning of dried pieces (steaming 30 min.) has a large effect on the recovery of shrinkage and cupping.

Table 1. Initial moisture contents of test pieces.

No.	1	2	3	4	5
Distance from cuticle mm	1.2	2.0	2.8	3.6	4.4
Moisture content %	63	89	109	127	130

Table 2. Shrinkage and cupping.

Drying condition		A 100°C rapid drying		B 100°C slow drying		E 30°C air seasoning	Initial moisture content %
Internode		11~13	14	11~13	14	11~13	
Width shrinkage (%)	1*	5.5	6.3	10.8	11.1	4.9	63
	2	5.0	5.3	12.0	11.0	4.4	89
	3	4.1	—	11.7	—	3.9	109
	4	3.9	—	12.5	—	3.8	127
	5	3.2	4.1	12.9	10.9	3.7	130
Thickness shrinkage (%)	1	6.1	6.6	6.7	7.0	4.7	
	2	6.9	6.9	9.3	8.2	4.1	
	3	6.5	—	8.5	—	4.1	
	4	8.2	—	10.7	—	3.8	
	5	8.1	7.3	13.3	10.2	4.4	
Cupping $1/R$ (1/cm)	1	+0.12	+0.1	−0.02	−0.03	+0.09	
	2	+0.105	+0.09	−0.07	−0.02	+0.08	
	3	+0.09	—	−0.04	—	+0.07	
	4	+0.055	—	+0.03	—	+0.04	
	5	+0.03	+0.05	+0.21	+0.07	+0.03	
Initial thickness (mm)		2.55	2.35	2.55	2.25	2.50	
Initial width (mm)		20.0	20.1	19.9	20.2	19.7	

*These No. are identically described in Table 1.

147. Hardness test of wood by a pendulous friction apparatus. Shitomo MAMADA (Bull. Tokyo Univ. Forests **49**, 205-216, 1955)

The pendulum vibration is forced to damp, when a pendulous friction apparatus makes swing on the wood surface. From the experiment, he obtained the damping curve between the amplitude of vibration and the time, which were characterized by a sloping curve, and found the damping was caused by the resistance which was almost the friction between the steel balls and the wood surface.

It is generally known that the damping ratio v is constant. Therefore he can see

$$y = y_1 v^{-m(N-1)}$$

where y: first amplitude
y_N: amplitude of vibration at N minute
m: frequency a minute, 48 times here.

That is $\log_{10} y_N = (\log_{10} y_1 + m\log_{10} v) - (m\log_{10} v)N$

The relation between the logarithm of amplitude, $log_{10}\ y$, and the time, N, in this experiment is almost characterized by a sloping straight line.

Next he could obtain logarithmic decrement $log_{10}\ v$ and damping ratio v, as the gradient of the sloping line gave respectively m times of $log_{10}\ v$ as to various wood species.

The relation between v and misture content of wood (HINOKI) indicates a sudden increasing of value of v beyond about 20% moisture content.

The empirical formula is following.

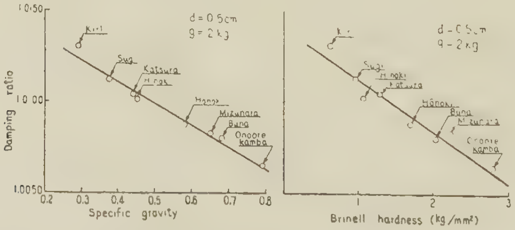
$$v = 17 \times 10^{-6} u^2 - 5 \times 10^6 u + 1.0069$$

where u: moisture content (%)

The relations between v and specific gravity, and that between v and BRINELL hardness of wood are shown respectively in Fig. 1, 2, both of which indicate intimate correlations. The empirical formulae are given as follows.

$$v = 1.059 - 0.0119\,G$$
$$v = 1.014 - 28 \times 10^{-4} H_b$$

where G: specific gravity
H_b: Brinell hardness (kg/mm²)



148. Water repellency, water absorption and moisture adsorption of wood. Treated with synthetic organosilicone componnds. Yoshiyasu YAMAGISHI (Journ. Japan Wood Research Soc. **2**, 36-42, 1956)

In this experiment, water repellency of wood treated with organosilicone compounds has been studied. For the purpose of giving water repellency to wood, two methods were chosen; one was overcoating by organosiloxane (T) and organosilane

(K) in ligroine, and the other was treating with organohalogenosilane in vapor state. As it is difficult to measure directly the angle of contact between the treated wood and water, the quality of water repellency of the treated wood has been evaluated by the angle of incline when the drops of water on the surface of wood start to flow. Numbers of water drops were 2, 3, 4, 5, 6 and 7 and they were dropped from a constant height (4 cm high from the wood surface) by a burret. The concentrations of organosilicones (T, K) were 10%, 5%, and 1%. The following results were recognized; (1) It is possible to evaluate water repellency by the angle of incline when the water drops start to flow. (2) To give water repellency to wood, it consequently diminishes the water absorption. (3) In moisture adsorption there is no change.

149. Studies on wood sanding. I. Yôji KIKATA (Journ. Japan Wood Research Soc. **2**, 79-84, 1956)

Regarding the experimental studies, on the belt-sanding of Katsura (*Cercidiphyllum japonicum* SIEB. et ZUCC.) by endless-sand-cloth with several conditions indicated in Table 1, the following results are recognized.

1. On the state of sand-cloth: The theoretically calculated number of grain-edge is much larger than that experimentally copied.

2. On the abrasion amount:

(1) The abrasion amount increases with the load. And the bite of one grain-edge f is calculated by the following formula.

$$f = \frac{S}{v} a,$$

f: bite of one grain-edge (mm), S: abrasion amount (mm/sec),
v: velocity of sanding (mm/sec), a: cut interval of grain-edge (mm),

and $$a = n\,\delta$$

δ: average interval of grain-edge (mm), n: number of sanding streaks in δ, but sanding-dust-size is much larger than calculated size by the formula. Many reasons (cell-construction and so on) are suspected, but the details remain unexplained.

(2) Abrasion amount increases with the sanding velocity, and its ascending rate is much more than expected by calculation from the summed sanding distance. And in the low velocity, the sand-cut seems to be incompleted.

(3) As to the realtion between the bite and the load, the following formula is applied.

$$f = K\sqrt{P},$$

f: bite of one grain-edge, K: constant, P: load applied on one grain-edge.

As grain-edge's number increases with the range of grain-size, in the constant load, the load of one grain-edge and the bite of one grain-edge decrease with the range of grain-size. As a result, the abrasion amount decreases with the range of grain-size.

3. On the roughness:

(1) As to the relation between the roughness and the range of grain-size, the following formula is applied.

$$x = b/2 \cdot \cot\varphi,$$

x: roughness, b: interval of sanding streaks, 2φ: cone's angle (sanding material)

and $b=\delta/n,\quad \delta=10/\sqrt{N}$ (mm),

N: number of grain-edge per square cm.

As a result, roughness x is in proportion to the range of grain-size. But the experimental roughness is larger than that calculated, depending upon vibration of machine and so on.

(2) From the view-point of recovery of roughness by water absorption, the adequate load and velocity are relatively high by the range of grain-size #60, because the recovery decreases with both the load and the velocity. By the range of grain-size #100 and #150, the adequate loads seem to exist under the range of this experiment, because the recoveries increase with the load. But the recoveries decrease with the velocity, so the adequate point of load and velocity must be determined by the combination of the two factors.

Table 1. Experimental conditions

Grain size (mesh)	Sanding velocity (m/sec)	Load (g/cm^2)
60	A: 6.2	a: 23
100	B: 9.1	b: 43
150	C: 12.3	c: 63

150. Studies on lignin XXIV. On the chlorination of lignin. Nobuhiko MIGITA, Junzo NAKANO and Atsushi ISHIZU (Japan Wood Research Soc. **1**, 55-59, 1955)

When lignin is chlorinated, chlorine atoms are introduced both to the nucleus parts and to the side chain parts of lignin molecules, and lignin becomes soluble, at least partially, in water and alkaline solutions. Some investigators have reported that this solubility of lignin may be attributed mainly to the substitution of hydrogen atoms for chlorine and demethylation of methoxyl group attached to the benzene nucleus. For confirmation of this opinion, it is necessary to determine the two kinds of chlorine attached to the nucleus and the side chain, separately.

In order to know whether the two kinds of chlorine can be separately determined or not, the authors examined the stability of chlorine on the twenty model compounds related to chlorinated lignin. The result shows that chlorine attached to the nucleus is not always more stable than chlorine attached to the side chain. So the method based merely on the difference of stabilities of chlorines cannot be adopted for the purpose. However, it is shown that if phenolic hydroxyl groups are covered with methyl groups, the chlorine attached to the nucleus becomes very stable. It is, therefore, possible to separate the two kinds of chlorine on the chlorinated lignin previously methylated. The authors devised a method of separate determination of the two kinds of chlorine in chlorinated lignin, which consists of the previous methylation and the after-treatment with an alkaline solution.

Then the two kinds of chlorine were determined separately by this method, on the wood flour samples (beech and spruce) chlorinated under the various conditions. The mild chlorination introduced the most parts of chlorine to the nuclei of lignin molecules. Under the strong conditions, not only the amounts of chlorine combined

with lignin increase, but also the percentages of the amounts of chlorine attached to the side chain, based on the total amounts of combined chlorine, increase.

151. The anti-pulping effect of the extraneous substances of larch heartwood in sulfite cooking (III). Nobuhiko MIGITA, Junzo NAKANO, Seiya TAMAI and Kinji NUMANO (Journ. Jap. Forestry Soc. **37**, 448-451, 1955)

It is generally known that larch heartwood is difficult to be pulped in a calcium-base sulfite cooking, and the pulping resistance of this heartwood has been attributed to the high contents of extraneous substances in the heartwood, such as dihydroquercetin (taxifolin) and ϵ-galactan. FUJII (1952) suggested that the difficulty might be caused by the decomposition of cooking liquor by these substances.

In the present research, the following samples were heated with a bisulfite liquor, and S_2O_3'' and SO_4'' produced in the liquor were determined: larch heartwood, pine heartwood, spruce wood, larch heartwood extracted with alcohol-benzene or hot-water, taxifolin and its related compound,s ϵ-galactan and some polysaccharides.

In the case of larch heartwood, apparently more SO_4'' was found than in the case of spruce and pine heartwood. If the larch heartwood was previously extracted with alcohol-benzene or hot-water, the amounts of SO_4'' found in the resulting liquor decreased. The bisulfite liquor containing taxifolin or ϵ-galactan gave more SO_4'' than the control.

From the results of the experiments, the following conclusion may be made. In the calcium-base sulfite cooking of larch heartwood, taxifolin and ϵ-galactan produce an appreciable amount of SO_4'', and consequently decrease the pH of the liquor. This makes lignin insoluble by the condensation of lignin molecules. The sulfuric acid thus produced in the liquor causes the degradation of cellulose and hemicellulose in the pulp.

Research on the swelling of fibers (I). Swelling test for the evaluation of dissolving wood pulp in phosphoric acid. Nobuhiko MIGITA and Hayao HOSOI (Bull. Tokyo Univ. Forests, **50**, 137, 1955)

For the purpose of the evaluation of dissolving pulp the swelling tests are often adopted. In this paper, first the swellingtest after HEIDE is examined, and second a new method is proposed by the present authors.

The HEIDE test cannot be considered to be suitable, because two or more of the swelling forms described by HEIDE appear at the same time, and this makes the evaluation of pulp difficult. Moreover, some fibers are possibly dissolved, so it is very difficult to get a preparation for a microscope which is representative of a whole pulp.

Then the authors propose the new swelling test for the evaluation of dissolving pulp which is slightly modified from the STEENBERG method. In this test the defects found in the HEIDE test are almost eliminated. This test has also the following advantages. Namely, the preparation of fibers, which are highly swollen and cannot be observed under a microscope with the usual method, may be examined more precisely with an application of the method of adding titanium oxide to them.

152. The relation between hemicellulose contents in pulp and its paper strength. Nobuhiko MIGITA, Takashi KANDA, Shuichi SATO and Yukio KOJIMA (Journ. Soc. Textile and Cellulose Ind. **12**, 14-18, 1956)

The effect of hemicellulose contents in pulp on beating rate and strength of paper made from it was studied.

In this study two methods were used, one the adding method (adding isolated hemicellulose to the standard pulp) and the other the extraction method (removing hemicellulose stepwisely).

In the former, when the hemicellulose is isolated with drastic agents, the chemical nature of hemicellulose is liable to chagen, so that it is impossible to say that the isolated hemicellulose will act in the same manner as it does in the original state. Therefore extraction method was employed in the present research.

For the preparation of chlorite holocellulose, thin pieces of beech and aspen wood were treated with hot acidified sodium chlorite. These chlorite holocelluloses were treated with KOH solution under nitrogen gas, in order to minimize the oxidation of cellulose. For hemicellulose extraction, KOH solutions of various concentrations (from 0.3 to 20%) were used in order to get a series of pulp in which the hemicellulose content was stepwisely arranged.

The beating rate and the sheet strength of this series of pulp were examined. From the results of this study it was concluded that there appeared to be the optimum hemicellulose content in pulp as far as the paper strength was concerned. Other observations were also made with regard to the results observed.

153. Studies on the color sulphate dulp (3). The effect of the color of the cooking liquor on the color of sulphate pulp. Nobnhiko MIGITA, Takashi KANDA, Hiroshi NISHIMUKA and Tsuneo MATSUMOTO (Journ. Jap. Tappi **10**, 20-24, 1956)

Some experiments were carried out on the following items: (1) Relation between the time of digestion and the color of cooking liquor. (2) Digestions in which cooking liquor is renewed halfway. (3) Digestions with cooking liquor containing some black liquor. The colors of liquor were estimated in their transmittances by photoelectric colorimeter. The colors of pulp were estimated by photoelectric spectrophotometer, and were shown by means of the I. C. I. system. The results may be summarized as follows: The color of the cooking liquor gives some effect on the color of pulp.

Within the range of the experiment, this effect is especially evident in the beginning of the digestion, and in the material, to be cooked, containing comparatively little non-cellulosic substances. If the material contains much non-cellulosic substances, this effect appears only in the beginning of the digestion. In such a material an addition of black liquor to some extent instead of white liquor, makes the color of pulp less reddish, though the brightness of pulp becomes low.

Lignin and carbohydrates, especially its decomposed products, in the cooking liquor may be responsible for the color of pulp. However digestion with water of pH 7 containing the decomposed products from xylose gives little effect on the color of pulp.

154. Composition of essential oil from the wood of *Chamaecyparis pisifera* Endl. Tomoichiro NAKATSUKA and Yoshiyuki HIROSE (Journ. Jap. Forestry Soc. **37**, 452-453, 1955)

It has been found that the essential oil from the wood of "Sawara" (*Chamaecyparis pisifera* ENDL.) consists mainly of *d*-cadinene and *l*-cadinol.

155. Composition of the essential oil from the leaves of "Nezuko" (*Thuja Standishii* Carr..) Tomoichiro NAKATSUKA and Yoshiyuki HIROSE (Journ. Jap. Forestry Soc. **37**, 496-498, 1955)

The leaves of "Nezuko" grown in the Tokyo University Forest at Chichibu were steam-distilled to give a 0.73% of essential oil. It has been found that α-pinene, camphene, *l*-fenchone, *l*-borneol, bornyl acetate, and a small amount of sesquiterpene alcohol are contained therein.

156. Metabolic product from aromatic compounds by the wood-rotting fungus *Porystictus sanguineus*.-I. Oxidation of benzoic acid and acelaldehyde from its medium. Kyoji MINAMI and Toshio FUKUZUMI (Journ. Jap. Forest. Soc. **38**, 225-229, 1956)

(1) Oxygen uptake with 1/833 M and $1/10^{-3}$ M benzoate by the wood-rotting fungus *Porysticutus sanguineus* was measured by means of the WARBURG's apparatus.

(2) Acetaldehyde, as 2,4-dinitrophenylhydrazone, was obtained from the medium of benzoic acid cultured by *P. sanguineus* at 26–36°C. for 24–48 hours. It was also found in the medium, cultured by the same fungus, of no appreciable carbon source, however its quantity was one-fifth of the quantity found in the former case.

(3) In one case, benzaldehyde was identified as 2,4-dinitrophenylhydrazone in the medium of benzoic acid cultured by the fungus, but it was not repeatedly obtained.

(4) After culturing at 30°C. for 24 hours, the quantity of recovered benzoic acid from the medium was ca. 50% of its quantity in the fresh medium.

VIII. Zootechnical and Veterinary Science

Abstract Nos. 157—187

157. Establishment of the inbred strain of mice with different mammary sensitivity to estrogen treatment. Jiro NAGAI, Motokazu YOSHIDA and Motoo NAITO (At the autumnal meeting in 1955, under the auspices of the eastern branch of the Endocrinological Society of Japan.)

It is a question that inbred strain of mice are always useful for bio-assay. This study was taken up to investigate how the mammary response changes following the brother-sister matings and to establish the inbred strain which shows uniform mammary response to estrogen treatment. The mice used were Kasukabe mice which were divided into two groups according to teh mammary response on the random mating stage and were inbred in brother-sister mating system for three generations. There was no remarkable change in the mammary response and body weight on the 35th day following inbreeding. It was found that the variation of mammary response was considerable within inbred lines. Then, from the variation of mammary response of progeny mice some families were selected as the breeding families.

158. Individual selection of mice by the selection index method. Jiro NAGAI, Motokazu YOSHIDA and Motoo NAITO (Jap. Jouan. Zootech. Sci. **26**, Suppl. 2:3, 1955)

It was attempted to select the individual mice for the mammary response to estrogen treatment and body weight on the 35th day by selection index method. The heritability of each character was considerably high. The genetic correlation between two characters was assumed as 0.3. The selection index was I=1.40 M-3.2 W in male mice and I=2.81 M-15.87 W in female mice when the genotype of the mammary response were weighted three times by one of the body weight (M and W mean the mamary response and the body weight on the 35th day). Accuracy of the selection, R_{IH}/R_{MH} was 1.04 in male mice and 1.29 in female mice.

159. Breeding of inbred mice with different mammary sensitivity to estrogen treatment. Motokazu YOSHIDA, Hiroshi NAGASAWA, Jiro NAGAI and Motoo NAITO (Jap. Journ· Zootech. Sci. **26**, Suppl. 2:3, 1955)

Kasukabe mice were divided into two groups according to the mammary response to estrogen treatment on the random mating stage, and were inbred in brother-sister mating for three generations. There was no remarkable change following inbeeding on the mammary response and body weight of 35 days old male and female mice. It seemed that there was no difference on the mammary response and body weight between two groups of mice. Both characters of some family composed of full brother or sister were larger significantly than those of other family. There was a highly significant correlation between mammary response and body weight in each group.

160. The normal mammary gland development and the mammary response of the inbred mice. Junzo YAMADA, Motokazu YOSHIDA, Takei CHIKAMUNE, Jiro NAGAI and Motoo NAITO (Jap. Journ. Zootech. Sci. **27**, Suppl. p. 5 1956)

Using mice of bc and swiss strain, inbred for more than 20 generations by brother-sister mating, normal mammary gland development and mammary response to estrogen treatment were investigated. The mammary gland area of bc and Swiss strain rapidly incraesed from about 20 days old and to about 60 days old, the mammary gland areas of each strain were respectively 100 mm^2 and 75 mm^2 in female, and was about 2 mm^2 in male in both strains. It seemed that there were no differences in the bud-formation and branching of duct between two strains. The mice of two strains were injected every third day subcutaneously five times with a total dose of 12.5 I.U. of estrogen from the 20th day and on the 35th day the mammary gland areas were measured. The coefficient of variation in the mammary response was 59–60% in bc strain and 46–53% in Swiss strain. Comparing these results with those of Kasukabe mice which were inbred for three generations in full-sib mating system and showed 30–43% of coefficient of variation in the mammary response, it seems that inbred strain does not always show the uniformity in various characters except the character on which the strain was characterized.

161. Prediction of daily performance in heifer by the method of induced lactation. Motoo NAITO, Akira OKUBO, Ko NEMOTO, Akitake ABE, Sohachi SUZUKI, Soichi KOZUKI, Makoto SAKURAI and Toshinobu KOZUKI (Jap. Journ. Zootech. Sci. **26** Suppl. 2:4, 1955)

The relationship between the induced lactation and the first normal lactation

was examined using three Holstein heifers. For the induction of lactation a daily dose of 100,000 I. U. of synthetic estrogen was injected ten times, subcutoneously on every third day. These heifers gave birth to offsprings normally. One of the three showed pregnancy elapsed long times after the last injection. Some indications were obtained from the results of three heifers that prediction of daily performance in heifer by the method of induced lactation will be possible as in virgin goat.

Four heifers treated with synthetic estrogen treatment showed induced lactation. One of the four heifers showed 8.90 kg of the maximum daily yield in an average of five days. The results obtained from these four heifers were similar to those of the three heifers described above. The udder of heifers, injected with estrogen, increased in their size rapidly and lactated normal milk one week after last injection. Heat was maintained for 20–30 hours. The first and second heat was rather long. The two of the four seemed to be pregnant by the insemination at the 5–6th heat but the others were not pregnant at that time.

162. The effect of prolaction on the mammary growth. Hideo MIZUNO, Kusuo IIDA and Motoo NAITO (Jap. Journ. Zootech. Sci. **27** Suppl. p 5 1956)

The effects of prolactin alone and in combination with estrogen on the mammary growth were examined with intraductal injection method.

Japanese White virgin rabbits were ovariectomized and injection of hormones was begun on the fifth postoperative day. Two pairs of mammary glands in abdominal region were employed in each animal, one gland of them belong served as control. Prolactin (1, 3, 5 or 10 I. U.) and/or estrogen (1, 3, 5, 10 or 20 I. U.) dissolved in 0.3 cc distilled water was injected every other day for the period from 9 to 15 days into a galactophore of each gland. The animals were killed on the second day after the last injection and the mammary glands were removed. A piece of tissue removed from the injected sector was prepared for the histological observation.

The results obtained were as follows; 1) In the well developed mammary gland with alveoli, prolactin promoted further alveolar growth and induced secretion. Estrogen alone did not induce secretion, while the effect of it on alveolar growth was not remarkable. The difference in the effect both on alveolar growth and on secretion between prolactin alone and prolactin with estrogen was not obvious. 2) In the gland having moderately developed duct system without any alveoli, prolactin induced the alveolar formation and moreover, in the more developed duct system it induced secretion following to the alveolar formation. By estrogen alone no alveolar formation was induced, and the effect of prolactin in combination with estrogen was not outstandingly different to that of prolactin alone. 3) In the gland with slightly developed or rudimentary duct system with no alveoli, prolactin and/or estrogen seemed to induce duct growth promotion, although any remarkable difference was not observed among the effects of these three hormonal treatments.

163. The sensitivity of chicken concerning vitelline producing capacity to the injection of synthetic estrogen. 1. On the individual difference of sensitivity. Kozaburo YAMAMOTO, Takashi OHARA and Tatsuo HOSODA (Jap. Journ. Zootech. Sci. **26** Suppl. 2: p. 9 1955)

From a result of estrogen administration in White Leghorn chicken, it was

recognized that the individual sensitivity has some close relation to his families' sensitivity. Separation was carried out with reference to sensitive and non-sensitive response the estrogen treatment. The chicken used in this experiment were the progenies from within-strain sib-mating. A daily dose of 0.425 mg of diethylstilbestrol was injected intramuscularly to chicken. Estrogen injection was started on the 61st day after hatching and coninued for 10 days. The sensitivity of chicken was shown by the days that serum vitelline reaction was obtained. The results obtained are summarized briefly as follows:

1) The sensitive group showed 75.0% positive reaction, but the non-sensitive group showed 29.4% positive reaction.
2) Significant positive correlation was present between the days necessary to positive reaction and age at first eggs. ($r=0.823$) No significant correlation was present in intensity and clutch size.

In conclusion, it appeared to be present that the sensitivities of chicken were under the genetical control and they were related to some of egg producing characters.

164. Morphological studies on the distribution of Vitamin C in the adrenal cortex of mice. II. Relationship between estrus cycle and the distribution type in adult female mice. Shigeharu ASAKURA and Shiichi NISHIDA (Jap. Journ. Animal Reprod. **1** [4], 119-120, 1955)

In the previous report, one of the authors reported that the distribution type of V. C. granules in the mice adrenal cortex have some correlation between sex and age. In this experiment, the relationship between the estrous cycle and the distribution types of V.C. granules were studied in adult female mice, and the following results were obtained.

(1) The distribution of the granules in adrenal cortex are fluctuated in accordance with the stages of oestrous cycle.

(2) At oestrous stage, the V.C. granules are distributed in all cortex except the X-zone in which few granules are detected, at proestrous stage, the distribution type are characterized by devoid of V.C. grainules in the outer fascicular zone. At met- and di-oestrous stages, the V. C. granules have almost the same distribution type.

(3) Although few large masses of V.C. granules were observed in the specimens at the oestrous stage, the relationship between these masses and oestrous stage can not be explained clearly.

165. Studies on the reappearance of the X-zone in the mouse adrenal cortex after the first parturition. Koshi MOCHIZUKI and Shiichi NISHIDA (Jap. Journ. Animal Reprod. **1** [4], 123-124, 1955)

Pregnancy was found to participate the degeneration of the X-zone in the young gemale mouse at an earlier age than it would have occurred normally. However, whether its regeneration following pregnancy will take place or not, still remains for elucidation, although in the observation of McPhail and Read ('42) the regeneration of X-zone following pregnancy, lactation may play a role in inhibiting repair of the zone in young adult female mice. In our experiments to test this problem 14 animals whose young were destroyed immediately after birth and another 14 which were

permitted to nurse their young, were used.

The left adrenals were removed immediately after parturition from all mice and the right adrenals removed after an interval of 10 to 50 days.

Histological observations of the right and the left adrenals showed that the X-zone had almost completely destroyed at parturition and no repair had occurred 10 to 50 days post partum with or without their young.

166. Effects of adrenalectomy upon the ventral prostate glands in mice. Shiichi NISHIDA and Koshi MOCHIZUKI (Endocrinologia Japonica **2** [4], 289-296, 1955)

The effects of adrenalectomy upon the ventral prostate glands of bc-strain albino mice were examined in the present study. Adrenalectomy was performed by three step method in normal or castrated immature and normal or castrated adult male mice. The results obtained were summarized as follows:

(1) Epithelial cells of the ventral prostate glands decreased their height in both immature (about twenty-five days of age) and adult male mice after castration, and light areas disappeared from all cells except a few columnar cells of the ventral prostate epithelium. These columnar cells had light areas in their cytoplasm. Interstitial tissues of the ventral prostates increased in about after castration.

(2) In castrated-adrenalectomized male mice, both immature and adult especially in adult ones fifteen or more days following castration, cell height of the ventral prostate epithelium decreased again and the cells showed typical flattened shape, and light areas disappeared completely from their cytoplasm after adrenalectomy. This effect of adrenalectomy was more distinct in the castrated adult than in the ventral prostate epithelial cells of the castrated-adrenlectomized adult animals. All these animals had well developed X-zones in their adrenals.

(3) Adrenalectomy exercised no recognizable effect upon the structure of the ventral prostate glands in the normal adult male mice, from the adrenal cortices of which all X-zone cells disappeared except only a few residual cells. As all of the non-castrated, adrenalectomized immature male mice died after the second operations, no effect of adrenlectomy could be studied in them.

(4) Many fuchsinophilic granules of various forms were found in cytoplasm of the cells of X-zone atfer stained by the Ponceau-fuchsin method.

These facts may suggest that X-zone of the male mouse adrenal cortex has some relationship to androgenic substances.

167. Influences of hypophysectomy in mice II Effects upon testis, ventral prostate, seminal vesicle and adrenal cortex of immature mouse. Shiichi NISHIDA and Koshi MOCHIZUKI (Jap. Journ. Zootech. Sci. **27** [1], 49-54, 1956)

Twenty immature male mice of bc-strain were hypophysectomixed at the age of twenty-three to thirty-nine days (twenty-eight to thirty days in most cases), and sacrificed at various periods after operation. Eleven litter-mates were used as controls, including six for reference controls. Fixing and staining were carried out as mentioned in report I of this series of paper. The results obtained were summarized as follows.

1) Macrospcopic observations: After hypophysectomy the testis and adrenals regressed significantly in size and weight, and the ventral prostates and seminal

vesicles did not develop. The testis turned brownish yellow, while the color of the adrenals and accessory reproductive organs faded. The changes in weight of the organs were shown in table I.

2) Histological observations:

Testis: The diameter of the seminiferous tublues decreased, and a part of the germinal epithelium fell into the lumen and degenerated after hypophysectomy. Spermatocyte disappeared completely by the thirtieth day afte roperation. The interstitial cells atrophied and decreased in number after operation and by the tength day their nuclei showed the wheel-cell-like figures. Cytolyses were also observed in some interstitial cells, the other cells being stained black strongly with Heidenhain's iron hematoxylin.

Adrenal: A slight hypertrophy in the cells of the zona glomerulosa and atrophy in those of the zona fasciculata were observed and lipid decreased in these cells. These changes became more prominent in the zona fasciculata as days passed. In the zona fasciculata cytolysis and karyopyknotic figures were also observed after hypophysectomy. Although the cells of the X-zone atrophied to a great extent and fauchsinophilia demonstrated by Zinsser and Zinsser's ('51) Ponceau-fuchsin methods disappeared from them completely, the X-zone still remained in the cortex after hypophysectomy.

Accessory reproductive glands: Both the ventral prostates and seminal vesicles did not grow after hypophysectomy, showing the immature type. The slightly developed accessory reproductive glands also regressed to the immature type after hypophysectomy.

In conclusion, the changes in the testis, adrenals and accessory reproductive glands of immature mice after hypophysectomy seem to be essentially similar to those observed in adult mice.

168. Hematological and histological changes induced by adrenocorticotropic hormone and formaldehyde stressor in the domestic fowl. Shigehiro MORITA and Shiichi NISHIDA (Endocrinologia Japonica **3** [1], 39-49, 1956)

In the present experiment, changes of percentage of leucocytes in adult chicken blood induced by ACTH injection and histological changes of lymphoid tissues and adrenals in young chick induced by formaldehyde stressor, were examined.

Hematological changes: Relative heterophilia and lymphopenia were obesrved in the treated chicks which were injected with 10 mg of ACTH intravenously or intraperitoneally, and these were not observed in the chickens injected with the same dose of ACTH intramuscularly or subcutaneously. It was found that pricking of comb has some stressor agentical effect upon blood in the fowl, and also it was suggested that Selye's stress concept should be applicable to the chicken.

Histological changes: Single comb white leghorn cockerels 3–4 weeks old were used. They were injected with 1 cc of 4% formaldehyde intramuscularly 3 times during 36 hours. They were sacrificed at the end of the period of 12 hours after the last injection. The decrease in weights of thymus, spleen and bursa Fabricii and hypertrophy of adrenal gland were observed. Histologically, in the thymus of the treated chicks, the thymocytes of the thymus cortex drained into medulla, so that the demarcation between cortex and medulla became invisible, and naked reticular cells

appeared in the thymus cortex. The number of Hassal-body increased relatively. and the PAS positive degenerating intercellular granules also seemed to increase in their number. In the spleen, severe involution of the lymph follicle in the white pulp, and heteropoiede in the red pulp were observed. Hyperplasia, hypertrophy, mitotic figures of the interrenal cells and loss of chromaffin substances in the chromaffin cells were observed in the adrenal gland. In the bursa Fabricii, though involutic change of the follicles was observed, other striking changes could not be confirmed histologically or cyotologically. From these facts, it could not be decided whether the bursa Fabricii is a true lymphoid organ or not.

These changes were comparable to those in mammals, and function of bursa Fabricii were discussed in the present paper.

169. Further studies on the direct transportation of testis hormone to the targets located close to the testicle. Yoshisuke SUZUKI and Sumio SHIMA (Proc. III International Congress on Animal Reprod. Sec. 1., 119-121, 1956). (in English)

A small amount of yellowish transparent fluid is always found in the *tunica vaginalis communis* of the goat. From the anatomical constitution of the scrotum in this species, this fluid is assumed to be exudation(s) from the adjacent tissues or organs, but not overflow of the abdominal fluid.

An androgenic property, the stimulation of epididymal growth, was demonstrated in the neutral ether extract of the scrotal fluid in the matured goat, assayed by a local application method in immature castrated rats. The activity of the scrotal fluid was ten times as much as that of the blood serum.

The concept presented previously in the study of rat that testicular androgen is transported to the adjacent targets, not only by the systemic blood circulation but also by some direct routes, seems to be applicable for the goat and even in the matured stage of the life.

170. On the induction of ovulation in mice and rats by the single subcutaneous injection of human chorionic gonadotropin (HCG). Teiichi ETO and Tomonori IMAMICHI (Endocrinol. Jap. **2**, 149-154, 1955). (in English)

Induction of the ovulation in mice with several gonadotropins has been applied to a bioassay of them.

In the present study, the bioassay of HCG was traced in mice and extended to rats and some considerations were given on the ovulation phenomena induced by HCG.

Various doses of HCG were injected to mature female mice and rats which showed late diestrous smear in order to determine the minimum effective dose. The animals were sacrificed at various intervals after the injection to secure the optimum time for the autopsy and the shortest time necessary to find the tubal ova.

The precipitation of the ovulation was judged by the presence or absence of the tubal ova under a dissecting microscope.

From the results in mice, the groups autopsied 18 hrs after the injection showed lesser responses than the 20 hrs groups, but the latter could resopnse as little dose as 0.25 MU.

Results in rats showed that the optimum time for autosy was 20 hrs after the injections, the minimum effective dose was 3 MU, and the shortest time necessary to find the tubal ova was about 12 hrs after the injection.

The mice were 5 or 10 times more sensitive than rats on the induction of the ovulation by HCG.

Moreover, in order to find whether the effect of HCG was mediated by the hypophysis or not, the rats of late diestrous stage were hypophysectomized before and after the injection of 10 MU HCG, and autopsied 20 hrs after the injection.

HCG could induce the ovulation regardless the absence or presence of the hypophsis, but not the group injected at 10 hrs after the operation.

171. An improved technique for hypophysectomy of domestic fowl. Teiichi ETO and Tomonori IMAMICHI (Jap. Journ. Animal Reprod. **2**, 65-68, 1956)

It has been considered that hypophysectomy of domestic fowl is more difficult than that of other animals, due to high motality after the operation and interfering of the operation by sevre hemorrhage.

In this technique, several improvements are introduced to the oral method of Rothchild in order to overcome these difficulties.

The operation is performed as follows. A bird is pretreated with hemostatic, Naphthionin, and anesthetized by the intravenous injection of pentobarbital. After laying its back down on an operating board, the head is fixed with our specially designed apparatus.

The orfice of eustachian tube is spreaded by a pair of spring steel spreader. Scraped the bottom of the orfice clean with a small cotton bulb, the bone of parasphnoid rostrum is perforated by a dental burr and point. Now, the communicating portion of internal carotid artery which provides a landmark of the hypophysis, becomes visible through the dura. The dura is carefully cut by a needle.

The anterior hypophysis can usually be sucked up by a cannula under the gentle sucktion of water pump. Even if the severe hemorrhage takes place, the removal of the hypophysis is done by controlling the suction pressure.

After the extirpation, penicillin is instilled in the bone hole.

In our operation, the complete extirpation was achieved in 7 out of 10 cases, the motality was none out of five cases allowed to live until 30 days after the operation.

172. The effect of lactation on the concurrent pregnancy in rats. (Preliminary report) Koji YOSHINAGA, Kiichi SEKIGUCHI and Tosiro HOSI (Jap. Journ. Animal Reprod. **1** [3], 107-108, 1955)

During lactation, the prolongation of pregnancy takes place in rodents, due to delayed implantation of embryos. In the present study, the delayed pregnancy was confirmed in rats which suckled 6 youngs. If the litter was taken off at the early period, 4, 6, 8 and 10 days of pregnancy, the duration of pregnancy showed 22, 23.2, 25 and 27.6 days respectively.

In the seven day lactation group (the litter was taken off on the 8th day of pregnancy), progesterone was injected daily for the first seven days of pregnancy. Daily does of 0.5 mg progesterone did not prevent the prolongation of pregnancy (26.7 days), while 1.0 mg daily dose could reduce it to the normal term (23 days).

173. Studies on the artificial insemination in rat. I. Induction of pseudopregnancy, collection of semen and technique of insemination. Shyoso OGAWA and Yoshisuke SUZUKI (Jap. Journ. Animal Reprod. **1** [2] 67-68, 1955)

The method of artificial insemination in the rat was studied inquiring the suitable period and site for the insemination. The following technique was proved to be most satisfactory.

The females having a consistent history of 4-day estrous cycle were selected, and for the induction of pseudopregnancy, their cervix uteri were stimulated electrically with 7.5 volt of alternating current between 8 and 9 p.m. on the day of proestrus.

Within 2 hours after the cervix stimulation, the fresh semen collected by the ether ejaculation without killing donar, was inseminated into the uterine horne through the cervical canal.

The orfice of cervix was brought into sight by straightening of the lines of vagina and cervical canal with aid of specially designed operation table and an ear speculum under the illumination of head lamp, and the introduction of semen into uterus by a blunted ½ hypodermic needle was easily achieved.

By this technique, the authors obtained the fertility nearly as much as in the animals allowed to copulate normally.

174. Studies on the artificial insemination in rat. II. Storage of semen with "Organ homogenate diluent". Shyoso OGAWA and Yoshisuke SUZUKI (Jap. Journ. Aninal Reprod. **2** [2], 55-58, 1956)

Survival of rat sperm in various tissue-extract-diluents was studied in comparison with that in diluents routinely used for the artificial insemination in domestic animals.

Liver, brain, heart, epididymis and abdominal muscle of the rat were homogenized at various concentration with either 0.9% NaCl solution or 5% glucose solution, and their supernatant fluids were used as the diluents of tissue extracts.

In the storage at 5°C, none of thirteen kinds of control diluents could maintain the sperm motility beyond two days, while some of the tissue-extract-diluents were found to be successful and satisfactory for the long storage.

The motilty was best maintained in the extracts of liver and brain, prepared at 20 g/*dl* concentration in either solution; the periods of sperm survival were 8 days (longest, 11 days) by the liver, 5.5 days (longest, 8 days) by teh brain in the NaCl preparation, and 7 days (longest, 9 days) by the liver and 5.5 days (longest, 8 days) by the brain in the glucose preparation.

In the storage at $0 \sim 1$°C, the glucose extracts of these two tissues could prolong the survival period of sperm much effectively than those in the storage at 5°C; the motile sperm was found for 20 days (longest, 24 days) in the liver and for 10 days (longest 16 days) in the brain extracts. But in the saline extracts, the sperm motility could not be maintained beyond two days in this temperature.

175. Analysis of the heart rhythm. I. On the periodic fluctuation of "R" spike heights. Toshio OKABE and Satoshi TOMINAGA (Jap. Journ. Vet. Sci., **17**, 73-77, 1955)

A coaxial needle electrode, of the type described by ADRIAN and BRONK, was inserted into the thoracic cavity near the apex of the heart for the purpose of leading action potential from the heart, and then connected to an amplifier of conventional

design and the amplified action potential was recorded by Yokokawa's electromagnetic oscillograph. The subjects were five healthy rabbits, and from 90 to 120 "R" spike heights of ECG were measured, and time series analysis was applied to these five series.

Results are as follows:

(1) An undulation with a period of $4 \sim 5$ seconds, is observed in each series.

(2) Each series has trend. Therefore it seems that there is also another undulation with a longer period than that of the above-mentioned one.

(3) Irregular fluctuation consists of complicate components and two of them are revealed.

a) A respiratory fluctuation with a period of about one second is separated. This results from the movement of the inserted electrode corresponding with the respiratory movement.

b) Another fluctuation with a period of less than 0.5 second is separated. The first term of serial correlation coefficients is negative and significant statistically in each series; that is, each value is not at random but two values adjoining each other are in the negative correlation. It is assumed from this fact that the function of the heart is regulated automatically.

176. Analysis of the heart rhythm. II. On the periodic fluctuation of "R" spike intervals. Satoshi TOMINAGA (Jap. Journ. Vet. Sci., **18**, 37-43, 1956)

It is evident that the nervous system is concerned with the regulation of the function of the heart. Therefore, the analysis of the heart rhythm may offer many valuable information about the regulating mechanism of the function of the heart. However, it is difficult to get a stable, long record of electrocardiogram with laboratory animals by the usual methods of leading. A new method of leading, which was invented in this laboratory, was reported in the previous paper.

In the present investigations, electrocardiograms were recorded under the normal condition, the anaesthetic condition (10 min. after injection of a 2.5% solution of the penthobarbiturate "Ravonal", giving 30 mg per kg.) and the cardiotonic condition (5 min. after injection of 1 c.c. of Vitacamphor), and the artificial hibernation (15 and 60 min. after injection of the chlorpromazine "Contomin", giving 15 mg per kg.).

"R" spike intervals were measured, succesively, and the time series analysis was applied to each series and the several kinds of periodic fluctuations were separated. The results obtained are summarized as follows:

(1) Though an undulation, with a period ranging from 11 to 15 seconds, is observed under the normal condition, under the cardiotonic condition, and under the artificial hibernation, this kind of undulation is not observed under the anaesthetic condition. Therefore, it is supported that this reflects the undulation of excitability in the higher level of the central nervous system, because the barbiturate anaesthetic exerts an inhibitory influence upon the cerebral hemisphere.

(2) In the irregular fluctuation, after eliminating the above-mentioned undulation, one kind of harmonic fluctuation is recognized, and the period of harmonic fluctuation under the anaesthetic condition, and under the artificial hibernation (60 min. after injection), accords with that of the respiration. From these results, it is

suggested that the respiratory mechanism exerts a certain influence on the regulation mechanism of the heart rhythm.

(3) In addition to the harmonic fluctuation, the rapid spiky fluctuation is separated in any case as a component of the irregular fluctuation. Using the periodic analysis, it is revealed that the spiky fluctuation with a short period is considerably regular under the normal condition and, furthermore, the period of this fluctuation is modified under the anaesthetic condition and under the artificial hibernation. It would seem that this reflects the fluctuation of the regulation of the heart rhythm and, especially, it should be emphasized that the period of the spiky fluctuation is modified under the different conditions.

177. Activity patterns of the so-called respiratory muscles. Hiroshi SAWAZAKI (Jap. Journ. Vet. Sci., **17**, 115-121, 1955)

The author was able to pick up some mechanical characteristics of the costovertebral joints, in the previous report. The present report is on the electromyographic study of each muscle which drives the respiratory movement, and the determination of the activity patterns of these muscles. With the original record and the average process of a single neuromuscular unit, the cooperative relation between the mechanical and functional characteristics are discussed.

The subjects are three well-trained dogs and two goats, and experiments are carried out in the intact condition and in the normal standing posture.

The results are as follows:

(1) Based on the activity pattern obtained here, the intercostal muscles, diaphragm, abdominal muscles and transversus muscle of the ribs are classified in the respiratory muscles. The intercartilageneous portion of the intercostal muscles and the abdominal oblique muscles are brought into play during the expiratory phase, and the others during the inspiratory phase. Thus, as far as some specific muscles come into play during only the expiratory phase, the expiratory movement is not passive.

(2) The serratus, iliocostal and scaleni muscles have the same patterns as the trapezius muscle which does not attach to the ribs. They work plastically and increase their activity in the inspiratory or expiratory phases.

(3) The first rib is fixed elastically by the plastic activity of the scaleni and serratus ventralis muscles, and serves as the fixed point of the respiratory movement of the thoracic cage.

(4) The activity of the intercostal muscles is different according to their respective spaces and the more hinder the space is, the more the activity of these muscles decreases. The inclination angles of their muscle fibres also decrease. This fact indicates that the intensity of muscular activity is closely connected with the mechanical characteristics.

(5) The activity patterns of the diaphragm and transversus muscle of the ribs are of the slowly augmenting type and the activity patterns of the abdominal oblique muscles are of the rapidly augmenting type. This is the same result as GESELL's. But, as for the intercostal muscles, the activity pattern of the interosseous portion (inspiration) and that of the intercartilageneous portion (expiration) are of the rapidly augmenting type with a noticiable feature.

178. On the activity phases of the respiratory muscles. Hiroshi SAWAZAKI (Jap. Journ. Vet. Sci., **17,** 231-234, 1955)

In the previous papers, the mechanical characteristics of the costovertebral joints and the activity patterns of each respiratory muscle, were reported. But the smooth respiratory movement was not made clear through these results, and the cooperation of the respiratory muscles needed to be investigated further to explain the smoothness of respiration.

Using five normal adult rabbits, under the intact condition and without binding the extermities, the pneumotachogram and the electromyogram of each respiratory muscle were recorded, synchronously, on bromide paper (the bipolar electrodes of silver needles were employed for leading electromyogram).

Most of the inspiratory muscles discharge synchronously at the beginning of inspiration, and consequently, it seems that a considerably great force is necessary to change the shape of the thoracic cage. On the contrary, due to the fact that the activity phases of the expiratory muscles slip out with each other at the beginning of expiration, this force is smaller than that at the period of inspiration, because the epxiratory movement is helped by the stress due to the torsion of the ribs and the elsaticity of the ligaments, etc.

The period, during which the abdominal oblique muscles work alone, is observed, and the intercartilagenous portion of the external intercostal muscles discharges only within the expiratory phase of the pneumotachogram. This will indicate that the expiration is not passive.

The activity phases of the inspiratory and the expiratory muscles overlap each other, and there is no period during which all respiratory muscles pause, simultaneously. Therefore the author believes that this is the most important fact to explain the smoothness and the elasticity of the respiratory movement.

179. The activity patterns of the intercostal muscles. Hiroshi SAWAZAKI (Jap. Journ. Vet. Sci., **18,** 33-36, 1956)

The fact that the activity patterns of the inercostal muscles of the fore intercostal spaces are different from the hinder spaces in dog and goat, was reported in the previous paper. The same results have been obtained in men. The phenomenon in this report was investigated, in detail, by the simultaneous recording of the electromyogram in the case of dog.

In the normal standing posture, the activity patterns of these muscles in the same intercostal spaces on both sides are equal in each space, because the number of discharges and the discharge interval of the single neuromuscular unit in the same intercostal spaces are almost equal on both sides, and these muscles are activated synchronously. And as for the results of the simultaneous recording of the fore and the hinder intercostal space on one side in the normal standing posture, the activity pattern of each space is equal to that in the previous report; in the fore intercostal space, the discharge interval is $80 \sim 120$ msec. and the activity pattern is of the rapidly augmenting type. On the other hand, in the hinder intercostal space, the discharge interval is $130 \sim 150$ msec. and the number of the discharges is remarkably fewer than that in the fore one. Moreover, the activity phase of the hinder space is included in that of the fore space.

In the tripedal standing posture, in which the body weight is shifted on one fore leg and both hind legs, the activity of this muscle in the fore intercostal space increases at the supporting side, and on the contrary, it decreases at the non-supporting side. Besides, the activity pattern of the non-supporting side attains the equal pattern of the hinder intercostal space in the normal standing posture, in the discharge interval as well as in the number of discharges. That is to say, the discharge interval of the non-supporting side is lengthened to 100 ~ 150 msec. and the number of discharges decreases to two or three. And the relative place of the activity phases between the supporting side and the non-supporting side is equal to that between the fore intercostal space and the hinder one in the normal standing posture. The serratus ventralis muscle, whose strong tonic contraction is necessary for the fixation of the shoulder girdle in the normal standing posture, is silent on the non-supporting side of the tripedal standing posture. Therefore, it is presumed in this case that the basic condition of the intercostal muscles of the non-supporting side is different from that of the supporing side.

From these results, it is believed that the basic condition is important in order to explain the difference in the activity patterns of the intercostal muscles in the normal standing posture.

180. Electromyographic study of postural adjustment. I. Electromyographic study of the tripedal standing posture in dog. Hichiro INADA (Jap. Journ. Vet. Sci. **17**, 65-71 1955)

Muscular activity, to maintain any posture, is adjusted by incessant voluntary and involuntary control and mobilized coordinately on the basis of mechanical characteristics of the skeleton. Muscular activity, to maintain the tripedal standing posture as an extremely asymmetrical posture, can be explained reasonably from this point of view. Experiments were carried out on a dog with her left forearm and forefoot tied together, and on another, about one month later after amputation at his left elbow joint. In both cases, antigravity muscles in action and intensity of their activity were investigated, electromyographically. Results were discussed from the above-mentioned point of view, and discussions were chiefly centered on results obtained from the experimental tripedal standing posture.

(1) Compared with the normal standing posture, important changes of the skeleton are as follows:

a. Decrease of the inclination (i.e., the more horizontal position) of the right scapula.
b. Maximum or terminal extension of the right elbow joint.
c. Adduction of the right antebrachium.
d. Increase of the inclination (i.e., the more perpendicular position) of the pelvis.

The center of gravity is displaced, latero-posteriorly, from the normal position by 'c' and 'd'. 'b' makes the basis for the stable fixation of the weight bearing anterior limb.

(2) Discharges of NMU undulate synchronously with postural antero-posterior and side-to-side sways of the body in the normal standing posture, but such undulation disappears in the tripedal standing posture.

(3) Changes of muscular activity are most prominent in the muscles of the anterior limbs.

On the supporting side (the right side in the present investigation), the fixation of the shoulder girdle is carried out by the serratus; very strong contraction of its cervical part prevents rotation of the scapula by gravitation. The brachiocephalicus pulls up the head of the humerus against gravitation and holds it in place, and thus the basis for fixation of the shoulder joint is made, and this joint is fixed, antagonistically, by increased activity of many muscles. The elbow joint is fixed from one side by its extensors at the position of maximum extension, limited mechanically by collison of the olecranon with the base of the olecranian fossa, and adduction, concurring with extension mechanically, is available for the lateral displacement of the center of gravity. Other joints are fixed from one side by flexors, as in the normal standing posture.

On the non-supporting side, slight muscular activity prevents detaching of the anterior limb the trunk.

(4) The sacrospinalis is called into activity and concerned in fixation of the more inclined pelvis with increased activity of the biceps femoris. The manner of fixation of other joints in the posterior limb is about the same as in the normal standing posture.

(5) Muscular activity, to maintain the tripedal standing posture in the dog with amputated leg, is generally wearker than that in the animal with extremities bound together, and it is shown that the foremer is adapted to the tripedal standing.

181. Electromyographic studies on the function of the skeletal muscles. Part 2. The forward-inclined standing posture of dog on the tilting plane. Hichiro INADA (Jap. Journ. Vet. Sci. **17**, 183-188, 1955)

Antigravity muscular activity maintaining the forward-inclined standing posture of dog on the tilting plane (15° and 25°) was investigated by means of electromyography. Based on the results, structure of this posture was discussed from the mechanical point of view and compared with that of goat discussed in the previous report.

(1) At an inclination of 15 degrees, the stance of the pelvic appendage is still considerably free but the typical forward-inclined standing posture is shown at the inclination of 25 degrees. Compared with the so-called normal standing posture on the horizontal plane, the more perpendicular position of the pelvis and the marked extension of the femoral and hock joints are essential to the forward incliantion of the body, but the extension of the knee joint, that is observed in the forward-inclined standing posture of goat, does not take place. When the standing plane is tilted, the inclination of the neck is not altered. Therefore, the neck is displaced in parallel, and the inclination of the scapula increases and the angle of the shoulder joint is unchanged. While the elbow joint is fixed at the position of the terminal extension in goat, the more the plane tilts, the more this joint flexes in dog. This is pointed out as a great difference between them; in other words, the manner of the
pointed out as a great difference between them; in other words, the manner of the
forward-inclined standing posture, which is unstable to the unexpected disturbance, is endowed with elasticity by such manner of the fixation of the elbow joint in dog.

(2) In the forward-inclined standing posture, the activity of extensors is enhanced, and that of some flexors, which function as the postural adjustment, is decreased. As a rule, the change of the density of EMG is parallel to the change of the discharge interval but this relation is not necessarily applicable to all cases. It seems that the change of muscular activity caused by tilting of the plane is not reflected so much in the density of EMG as in the discharge interval.

Part 3. Effect of training on the function of the skeletal muscle (I). Hichiro INADA (Jap. Journ. Vet. Sci. **17**, 235-238, 1955)

The effect of training on the skeletal muscle has often been investigated both morphologically and biochemically. This experiment was designed to demonstrate, functionally, the effect of training upon the maintenance of the normal standing, and was performed on three dogs: one of them was trained to the normal standing for about 5 months and the others were untrained. Electromyographic recordings of a single NMU from the gastrocnemius of each subject were carried out under 3 types of visual conditions: the normal visual condition, entire darkness, and the moving visual condition (a side-to-side swinging luminous point at the rate of 54 cycles-per-min. located at eye-level and the distance of 40 cm from eyes). These visual conditionings were employed in consideration of the influence of the various visual conditionings on the manifestation of the effect of training.

Using the analysis of variance, the effects of training and the visual conditioning were tested, statistically, for S_1 (the standard deviation calculated from the original series) and S_2 (the standard deviation of the series of irregular fluctuation), separately. On this occasions, S_1 and S_2 corresponding to the average of discharge interval from 70 to 100 msec. were used as data of the analyses of variance, because there was a posibility for the common relation between the average and the standard deviation of discharge interval to cover the effect of training or the visual conditioning. In both analyses of S_1 and S_2, the effect of the visual conditioning was not significant. This result does not indicate that the visual condition is unconcerned in the maintenance of the normal standing, but that the visual conditionings in this experiment are poor, because some defects are pointed out in the methods of the visual conditionings. Individual difference was significant only between the trained and the untrained subjects in the analysis of S_2, whereas it was significant between each pair of subjects, regardless of training, in the analysis of S_1.

Compared with the $\bar{\tau}_2$-S_2 curve of the untrained subjects ($\bar{\tau}_2$ is the average of discharge interval of the original series), the $\bar{\tau}_2$-S_2 curve of the trained subject is dispaced to the right side. This displacement shows that training developes the function of the NMU, and the NMU of the trained subject discharges at less variance of discharge interval than that of the NMU of the untrained subject. Taking this displacement of the $\bar{\tau}_2$-S_2 curve into consideration, it is evident that the significant individual difference in the analysis of S_2 is based on the functional development of the NMU brought about by training, and it should be emphasized that the effect of training was demonstrated in relation to the function of the skeletal muscle.

182. Notes on some cases of malt rootlet poisoning in dairy cattle. Yoshio OHKUBO, Norimoto URAKAWA, Toyoaki HAYAMA, Yoshio SETO, Takayoshi MIURA, Yasuhiko KANO, Shigekatsu MOTOYOSHI, Shutaro YAMAMOTO, Kiichi ISHIDA, Hiroshi IIZUKA and Mitsugi IIDA (Jap. Jour. Vet. Sci. **17** [4], 146-151, 1955)

Two cases of food poisoning in dairy cattle were brought under observation in autumn 1954. From the results of the survey done by the authors, the poisoning cases were believed to be due to the malt rootlet given as a food.

The toxicity of the malt rootlet was manifested by symptoms in a calf which had been fed experimentally.

The disturbances were characterized by the following:

(1) Tremore, lumbar paralysis, anorexia.

(2) On postmortem and histopathological examination, marked disturbances of circulation, such as congestion of various organs, petechiae in serous membranes, and hemorrhage from small vessels of the brain were noted.

Microorganisms of the malt rootlet were isolated.

Penicillium urticae, which has been said to be the cause of the poisoning, was not found in these cases.

183. Factors necessary for E. tenella infection of chicken. Part 1. Influence of the digestive juices on infection. Part 2. Influence of the pancreatic juice on infection. Miyoshi IKEDA (Jap. Journ. Vet. Sci. **17** [5], 197-200, Ibid. **17** [6], 225-230, 1955)

Results obtained demonstrated that the pancreatic juice was an important factor necessary for E. tenella infection in the chicken.

Part 3. Influence of the upper alimentary canal on infection. Miyoshi IKEDA (Jap. Journ. Vet. Sci. **18** [1], 25-30, 1956)

Concerning the possible actions of the alimentary canal on E. tenella infection in chicken, it was recently reported that the liberation of the sporozoites from oocysts was brought about by the mechanical action in the crop and the gizzard, contrary to the common view that the action was due to some enzymes present in the digestive juices. In view of the fact that there is little information on this point, it is hardly possible, at present, to come to any definite conclusion with regard to E. tenella infection.

In the previous papers it was demonstrated that the pancrestic juice was an important factor necessary for E. tenella infection in chicken. In this paper, the author describes further experiments which were carried out, because such discrepancies, as mentioned above, made it desirable to know what effect the upper alimentary canal (crop, proventriculus, gizzard), alone, has on the infection of E. tenella in chicken.

(1) In order to observe the changes of the sporulated oocysts of E. tenella in different parts in the upper alimentary canal other than the gizzard, oocysts were introduced into the following pouches which were prepared by ligating a part of the crop, proventriculus or gizzard, respectively. One to two hours or, in some cases, one to two days after the introduction of the oocysts, the microscopic examination were made which indicated the following results.

In general, although swelling, folding and rarely, rupture of the membranes of some oocysts could be observed, it was impossible to ascertain the decisive evidence of liberation of sporozoites from the oocysts under special experimental conditions.

(2) Further attempts were carried out to know the possible effects of only the crop or gizzard by a method using chickens from which the crop or the gizzard was surgically removed, and inoculated by introducing oocysts with a rubber tube inserted per os.

In both cases, the infection in the chickens so operated on was similar to the infection found in normal chickens.

(3) In the hope of obtaining decisive evidence or the possible effects of only the upper alimentary canal, without the action of the lower intestine other than the duodenum, an attempt was made, in which a distal part of one side of the ceca was sected and the end of the cecal segment was transplanted into the upper portion of the duodenum. It was ascertained, through the preliminary experiments, that 4-5 days after the operation the intestinal contents passed down from the gizzard to the duodenum, and entered into the transplanted ceca and the contents were found to be quite different from those of the normal ceca, indicating the similar appearance and filling of thoes the duodenum and, in addition, the transplanted ceca was capable of supporting E. tenella growth.

None of the transplanted ceca became infected, in spite of infection of the unoperated site of the cera, when dosed with sporulated oocysts of E. tenella.

From the data presented here, it seems that the upper alimentary canal, other than the gizzard, is not necessarily essential for E. tenella infection in the chicken, though there remains the possibility of such a minor role as the more rapid effects of duodenal juices or pancreatic juices after exposure of the oocysts to the upper alimentary canal.

Part 4. Investigations of the site of the action of the pancreatic juice on infection. Miyoshi Ikeda (Jap. Journ. Vet. Sci. **18** [2], 45-52, 1956)

Investigation were carried out to clarify the site of the action of the pancreatic juice on E. tenella infection in chicken.

From the results reported, none of chickens with the ligated pancreatic ducts became infected. These negative results led the author to quetiosn whether the cecal contents and cecal tissue might be altered physiologically, by ligating the pancreatic ducts and thus present unsuitable conditions for the coccidial growth.

(1) To clarify the problem, the infection of the ligated chickens was attempted using E. tenella merozoites collected from the cecal contents of some chickens destroyed on the 4th-5th day after infection, and introducing them into the portion at the entrance of the cecum into the intestine, rectally. The results obtained indicated that the cecal tissues of the ligated chickens supported the growth of coccidia, as in the case of the normal control, the alteration not being enough the reduce the possibility of infection because, even in this case, infection resulted with the appearance of oocysts in the discharge of these chickens 2 days after the introduction of the merozoites.

(2) On the basis of the hypothesis that the pancreatic juice acts on the excystation of the sporulated oocysts in the intestinal canal, all the feces passed by the

ligated (pancreatic ducts) and control chickens were collected during the 2-6 hours following the introduction of the sporulated oocysts into the crops and the relative number of sporulated oocysts in each group of feces was estimated by comparing them per gram of feces discharged by these chickens. It was estimated that the feces of the ligated chickens contained 19 times as many oocysts as those of the controls.

(3) The experimental introductions of sporulated oocysts into chickens, both normal and with ligated pancreatic ducts, by unnatural routes (duodenum and ceca) were carried out to investigate the effects of pancreatic juice on the infection. While the sporulated oocysts introduced into the duodenum of the ligated chickens produced no evidence of infection, although infection resulted in the normal chickens, positive results were obtained by introducing oocysts mixed with trypsin. In the case of the introduction of sporulated oocysts into the ceca of the normal and ligated chickens, none of them became infected, but the injection of oocyst suspension containing trypsin resulted in infection.

(4) The investigations of the effects of heating trypsin or pancreatin solution in the case of E. tenella infection on chickens with ligated pancreatic ducts indiacted that the decrease of the activity of those enzymes was considerably inhibitory to E. tenella infection in vivo.

Results described above indicated that the pancreatic juice was an essential factor for E. tenella infection, and the main site of the action should be the excystation of oocysts in the intestinal canal, and suggested that proteolytic enzymes in the pancreatic iuice might be essential components for infection. In the addition, the previous reports regarding the influences for infection, were also confirmed by this finding.

184. Effects of ACTH, epinephrine and atropine on the blood picture of the dog

Masaaki HATAYA, Tetsuo FUJITA, Hikozo ICHIKI, Shigekazu MOTOYOSHI and Yasuto KUSUNOKI
(Jap. Journ. Vet. Sci. **18**, 1-10, 1956)

It was indicated by Harlow and Selye that very characteristic changes in the blood picture were obvious during the alarm reaction of the general adaptation syndrome. There was a pronounced increase on the total white blood count, due to neutrophilic leucocytosis with eosinopenia and relative, or even absolute, lymphopenia. Thorn observed the remarkable eosinopenia in the circulating blood after the administration of ACTH and proposed the Thorn test, as an activity test using this principle.

Recant et al pointed out the possible application of epinephrine administration as an activity test of the pituitary-adrenal system according to the observation of Vogt and Long.

Selye pointed out the unspecific hypertrophy of the adrenals following atropine administration, while Vogt described no increase of biocorticoids contents in the adrenal vein blood in case of atropine administration. However, Dordori reported a significant decrease of the ascorbic acid contents in the adrenal cortex of the rat after tntraperitoncal administration of atrophine, with a dose of 20 mg. per 100 mg. of body weight.

Examination were made over a period of 6 hours after administration of the

agents on the fresh blood samples taken from the cephalic vein of the dog. Hemoglobin content was determined by the oxyhemoglobin method. Total white blood count was made in 4 counting chambers (Spencer model) in the usual manner. Eosinophil was counted by Randolph's chamber method. Two Fuchs-Rosenthal counting chambers were used. The blood smears were stained with Giemsa's stain and 400 leucocytes were counted. Blood glucose was determined by the method of Hagedorn-Jensen. The dogs used in this experiment were fasted about 16 hours before experiments.

(1) Diurnal fluctuation.

In the dogs, the results obtained revealed a slight influence of restraint, bleeding and fasting on the blood picture.

(2) ACTH.

ACTH, diluted at a rate of 10 mg. in 1 cc. of normal saline, was administered to 18 dogs intramuscularly, with the doses of 0.94 to 2.74 mg. per kg. of body weight (15 mg. to 14 dogs, 20 mg. to 3 dogs and 25 mg. to one dog).

Changes in the hemoglobin contents were very slight following a single administration of ACTH.

The total leucocyte counts showed an increase of 20-30% during the period of 2 to 6 hours after injection. A maximum eosinophil fall was seen at 4 hours and 5 hours after ACTH administration, and the average decreases of absolute eosinophil counts were 54% at 4 hours and 42% at 6 hours. The rate of the eosinophil fall was independent upon the initial value. The principal factor of the leucocyte increase was the rise in the neutrophil count, which was about 78% at the time of 4 hours. Absolute lymphopenia was not apparent.

The blood sugar level did not show a remarkable change.

(3) Epinephrine.

Epinephrine chloride, 1:1000, was injected, subcutaneously, with a dose of 1 cc. or 0.7 cc.

Changes in the hemoglobin contents were not observed.

The total white cell counts showed a 24% increase at 4 and 6 hours after injection. The decrease in the eosinophil counts was 52% at 4 hours and 64% at 6 hours. The neutrophils showed a remarkable increase, while the absolute decrease of the lymphocyte counts was 50% at 4 hours and 32% at 6 hours.

The blood sugar level showed a pronounced rise which would be due to glycogenolysis.

(4) Atropine.

0.1% solution of atropine sulfate at the dose of 1 mg. per kg. of body weight was injected subcutaneously.

The hemoglobin contents manifested a slight rise.

The total white cell counts showed an increase of 32% at 4 hours and 37% at 6 hours after administration. This increase was mainly due to the increase of neutrophils, which was 78% at 4 hours and 76% at 6 hours. The absolute eosinophil counts revealed a decrease of 53% at 4 hours and 62% at 6 hours. These figures of the eosinophil fall were identical with those in the case of epinephrine adminitsration. The lymphocyte counts showed an absolute decrease of 30% at 4 hours and 17% at 6 hours.

The blood sugar level showed a rise of 10% at 2 hours and returned to initial value at 4 hours.

185. Studies on the treatment and prevention of reproductive failures in livestock. II. Bacteriological examination of the vagina and uterus of infertile cows. Yuichi OCHI, Manabu OGATA, Kazuo UCHIDA, Shin-ichiro, KONISHI, Takayasu TAKIZAWA and Ryotaro ISHIZAKI (Jap. Journ. Vet. Sci. **17**, 217-223, 1955)

In order to ascertain the causes of the non-contageous common diseases in the sexual organs, which are responsible for reproductive failures, the previous study was made on the flora found in the vagina and uterus of healthy cows, as the basic experiment. In the present study, the authors carried out bacteriological examinations on the flora found in the vaginae and uteri of so-called infertile cows making comparison with the above mentioned study.

The experiments were made on 144 dairy cows determined, clinically, to be infertile and 88 slaughtered cows, for the period of from Sept. 1951 to March 1954.

Materials used for this study were the vaginae and uteri of cows. The diseases responsible for the infertility were classified as follows:

Endometritis	47%
Retained Placenta	24%
Ovariancyst etc.	13%
Others	15%

Methods for this examination were almost the same as mentioned in the first report. In the cases of both dairy cows and slaughtered cows, the vagina was examined by the swab method and regarding the uterus, the examination was made on the first, one drop obtained after irrigation of Ringer's solution by a sterile irrigator.

In the bacteriological examination, out of the 144 infertile cows, 31 were found to be positive in the vagina, 65 in both vagina and uterus, 17 only in the uterus, while 31 were negative in both organs. That is, 86 cows were positive in the vagina and 82 were positive in the uterus.

Moreover out of 38 slaughtered cows, 13 were positive only in the vagina, 18 in both the vagina and the uterus, 3 only in the uterus, while 4 were negative in both organs. That is, 31 cows were positive in the vagina and 21 were positive in the uterus.

The families of those bacteria recovered were as follows, and the frequency of their appearances were in the order listed below.

In the case of dairy cows.

(1) Micrococcaceae (Micrococcus pyogenes var. albus, aureus, Micrococcus citreus and few other non-identified Gram-positive cocci).

(2) Lactobacteriaceae (Streptococcus).

(3) Enterobacteriaceae (Esch. coli and few other Proteus, non-identified non-lactose fermenting organisms).

(4) Bacillaceae.

(5) Non-identified Gram-negative bacilli.

In the case of slaughtered cows.

(1) Micrococcaceae (Micrococcus pyogenes var. albus, aureus, Micrococcus citreus and few other non-identified Gram-positive cocci).

(2) Lactobacteriaceae (Streptococcus).

(3) Enterobacteriaceae (Esch. coli and few other Proteus, non-identified non-

lactose fermenting organisms).

(4) Non-identified Gram-positive non-spore bearing bacilli.

(5) Non-identified Gram-negative bacilli.

(6) Corynebacteriaceae (Not including Cory. pyogenes).

(7) Bacillaceae.

No special relation was found between clinical classification of diseases, and species and quantity of the flora.

There was no remarkable difference in the family and quantity of the flora.

There was no remarkable difference in the family and quantity of flora between infertile cows and healthy ones except that the rate of the bacterial appearance in the uterus of infertile cows was rather higher.

186. Studies on toxoplasmosis in animals II. Report on two canine cases. Shutaro YAMAMOTO, Kiichi ISHIDA, Kosaku FUJIWARA, Shingo ITO and Katsumoto UEDA (Jap. Journ. Vet. Sci. **17**, 79-85, 1955)

Canine cases are predominant among the reports of animal toxoplasmosis. It was also determined, by serological surveys, that considerable number of the dogs showed positive reaction against SABIN-FELDMAN's dye-test or compliment fixation test. Moreover, dogs have been suspected as a possible reservoir of human toxoplasmosis because of their peculiar susceptibility to this disease and close relationship to human beings.

The first case of canine toxoplasmosis in Japan was reported by HAMADA in Hokkaido in 1951, but the isolation of the parasites was failed in that case. The present authors have isolated a strain of Toxoplasma from a cat and the detail was reported in the preceeding paper.

Soon after the isolation of the cat strain of Toxoplasma, two shepherd dogs kept in the house of a physician in Tokyo, came to our veterinary clinic with the pneumonic symptoms. No nervous symptom was noted except a slight spasmus of the eye-lids in the second case. They were diagnosed as distemper pneumonia and both died in succession after about 3 week's illness. The postmortem findings were almost the same in both cases. Necrotic foci of greyish yellow color were noted throughout the lung together with pneumonic consolidation. There were also numerous necrotic foci in the pancreas and a soy-bean sized necrotic nodule in the bladder wall. Typical Toxoplasma parasites were easily demonstrated in the smear preparation of these necrotic foci, liver, heart muscle and brain. At histopathological examination of the lung, besides the necrotic lesion due to Toxoplasma, there was also evidence of distemper pneumonia. Eosinophilic cytoplasmic inclusion bodies were found in the mononuclears and multinucleated giant cells in the alveoli. So it was believed that these were probably combined cases of toxoplasmosis and distemper. Numerous Toxoplasma parasites were found free or in cluster in the section of the necrotic foci of the lung, liver, pancreas, urinary bladder and intestinal wall. Pseudocysts of the parasites were found in the brain and heart muscle, but the reaction around the pseudocysts was minimum.

A strain of Toxoplasma was isolated from the second case by mouse passage.

187. Studies on infectious hepatitis in the dog (1). Yuichi OCHI, Shin-ichiro KONISHI, Takayasu TAKIZAWA, Takeji IKEGAMI, Shutaro YAMAMOTO, Kiichi ISHIDA and Akio SATO (Zbl. Vet.-Med. **3**, 55, 1956)

Infectious canine hepatitis was identified as a disease entity of the dog by Rubarth in 1947, and soon after his recognition, it has been reported from many countries of the world. In Japan this diesase was observed pathologically in Hokkaido by FUJIMOTO et al. in 1953, although no experimental inoculation was performed.

In September 1954, in Tokyo, authors had a chance to examine a carcass of a 10 months-old Spitz suggestive of this disease and examined pathologically and tried the transmission experiments of the virus (D43 strain) to young puppies and compared it with other known strain of the infectious canine hepatitis virus derived from other countries.

The disease in dogs can vary in severity even among a little, but recovery is usual. Significant changes of the disease were high body temperature and decreased white blood cells. There seemed to be a correlation between the degree of leucopenia and the severity of illness. Often the healthiest and liveliest puppies in a litter were the most severely affected. The mortality rate may sometimes be as high as 30%.

The autopsy findings in transmission experiments were very similar to those of the original material with respect to the hepatitis and the characteristic edema of the gall bladder. The histopathological findings show that the vascular system as well as other organs of importance are damaged no less than the liver. In fatal cases numerous intranuclear inclusion bodies can be found in the liver cells and in other endotherial cells. In severe non-fatal cases, very few inclusion bodies may be found although the typical liver damage is seen.

Authors have not yet succeeded in isolating the viruses in the embryonated hen's eggs or in white mice.